

Lockheed Environmental Systems & Technologies Co.
Lockheed Analytical Services
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0044369

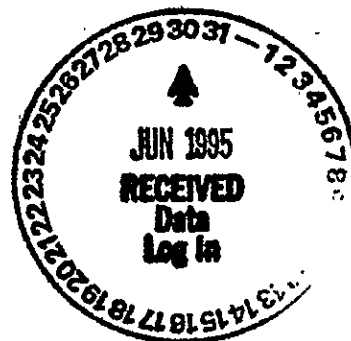
LK 4482

LOCKHEED MARTIN



June 29, 1995

Ms. Joan Kessner
Bechtel Hanford, Inc.
345 Hills
P.O. Box 969
Richland, WA 99352



RE: Log-in No.: L4482
Quotation No.: Q400000-B
SAF: B95-049
Document File No.: 0511596
BHI Document File No.: 221
SDG No.: LK4482

The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 11 May 1995.

The temperature of the cooler upon receipt was 2°C. Sample containers received agree with the chain-of-custody documentation. Sample containers were received intact. Samples were received in time to meet the analytical holding time requirements.

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Kathleen Hall at (509) 943-4423.

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Lockheed Analytical Services

Log-in No.: L4482
Quotation No.: Q400000-B
SAF: B95-049
Document File No.: 0511596
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SDG No.: LK4482
Page1

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

" I certify that this data package is in compliance with the SOW, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the Laboratory Manager or a designee, as verified by the following signature."

Sincerely,


Kathleen M. Hall *for KMH*
Client Services Representative

cc: Client Services
Document Control

**CASE NARRATIVE
 INORGANIC NON METALS ANALYSES**

The routine calibration and quality control analyses performed for this batch include as applicable: instrument tune (ICP/MS only), initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), ICP interference check samples (ICP only), serial dilutions, analytical (post-digestion) spike samples, matrix spike (predigestion) sample(s), duplicate sample(s).

Preparation and Analysis Requirements

- One water sample was received for LK4482 and prepared as batch 511bh and analyzed for selected analytes as requested on the chain of custody. Quality control analysis was performed on the following sample:

| Client ID | LAL # | | Method |
|-----------|---------|---------|---|
| BOFKH6 | L4482-5 | DUP | 160.1 TDS |
| | L4482-3 | MS, DUP | 300.0 Orthophosphate, Fluoride, Chloride, Nitrate-N, Nitrite-N, Sulfate |
| | L4482-4 | DUP | 310.1 Alkalinity |
| | L4482-6 | MS, DUP | CLP Cyanide |

Holding Time Requirements

- All samples were analyzed within the specified holding time.

Method Blanks

- The concentration levels of all the requested analytes in the method blank were below the reporting detection limits.

Internal Quality Control

- All Internal Quality Control were within acceptance limits.

Kay McCann

May 18, 1995

Prepared By

Date

CASE NARRATIVE INORGANIC METALS ANALYSES

The routine calibration and quality control analyses performed for this batch include as applicable: instrument tune (ICP/MS only), initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), ICP interference check samples (ICP only), serial dilutions, analytical (post-digestion) spike samples, matrix spike (predigestion) sample(s), duplicate sample(s).

Preparation and Analysis Requirements

The samples were received in on May 11, 1995. They were logged in as L4482 and prepared and analyzed in batches 511 bhT for total metals and 511 bhD for filtered water.

Holding Times-

All samples were analyzed within the method-specific holding times.

Method Blanks-

The method blanks were free of contamination.

Internal Quality Control-

All Internal Quality Control were within acceptance limits with the following exception: The matrix spike recovery for bismuth in the filtered water analysis was outside of acceptance limits (27%). The recovery based on the LCS (99%) support that the analytical system was operating within control limits.

Sample Results-

Bismuth was determined by ICP-MS, as approved by Clay Smith of Bechtel Hanford.

Shellee McGrath
Prepared By

June 29, 1995
Date

CASE NARRATIVE RADIOCHEMICAL ANALYSES

The routine calibration and quality control analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, duplicate samples.

Holding Time Requirements

All holding time requirements were met.

Chemical recoveries and MDAs, where applicable, can be found on the preparation and calculation worksheets of the attached raw data for each method.

Analytical Method

Gamma Spectrum Analysis

The gamma spectrum analysis was performed using LAL-91-SOP-0063. All samples were analyzed on batch #23211, which contains a method blank (MB), two duplicates (DUP1, DUP2), and a laboratory control sample (LCS). The DUP2 for Cs-137 was out of limits; however, since the Cs-137 DUP1 and both Pb-214 duplicates were within limits, the data is considered acceptable. All other QC criteria were met.

Gross Alpha Beta

The gross alpha beta analysis was performed using LAL-91-SOP-0060. All samples were analyzed on batch #23215, which contains an MB, DUP and LCS. No problems were encountered during preparation or analysis, and all QC criteria were met.

Plutonium Isotopic

The plutonium isotopic analysis was performed using LAL-91-SOP-0108. All samples were analyzed on batch #23154, which contains an MB, DUP and LCS. The duplicate (sample #23154DUP1) has a poor chemical recovery and only three counts. The duplicate uncertainty shows that the detected value is not significantly different from zero. No matrix spike analysis (MS) was performed due to insufficient sample. All other QC criteria were met.

Strontium-90

The strontium-90 analysis was performed using LAL-91-SOP-0196. All samples were analyzed on batch #23179, which contains an MB, DUP and LCS. During preparation, the samples were wetashed under the heat lamp with concentrated HNO₃ to get rid of the excess organic materials. This was done in the original conical planchets. After they were dried, they were reweighed. There was insufficient sample for an MS analysis. All other QC criteria were met.

Technetium-99

The technetium-99 analysis was performed using LAL-91-SOP-0169. All samples were analyzed on batch #23139, which contains an MB, DUP1, DUP2, and LCS. The second duplicate (DUP2) was out of limits; however, since DUP1 was within limits, the data is considered acceptable. No matrix spike analysis was performed due to insufficient sample. All other QC criteria were met.

Total Uranium

The total uranium analysis was performed using LAL-91-SOP-0168. All samples were analyzed on batch #23131, which contains an MB, DUP, LCS and MS. No problems were encountered during preparation or analysis, and all QC criteria were met.

Tritium

The tritium analysis was performed using LAL-91-SOP-0066. All samples were analyzed on batch #23181, which contains an MB, DUP, LCS and MS. No problems were encountered during preparation or analysis, and all QC criteria were met.

Yvonne M. Jacoby
Prepared By

June 20, 1995
Date

Lockheed Analytical Services
DATA QUALIFIERS FOR INORGANIC ANALYSES

[Revised 08/28/92]

| For Use on the Analytical Data Reporting Forms | |
|--|---|
| B | <i>For CLP Analyses Only</i> -- Reported value is less than the contract required detection limit (CRDL) but greater than or equal to the instrument detection limit (IDL). |
| C | <i>For Routine, Non-CLP Analyses Only</i> -- Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL). |
| D | Presence of high levels of interfering constituents required dilution of sample which increased the RDL by the dilution factor. |
| E | Estimated value due to presence of interference. |
| H | Sample analysis performed outside of method-or client-specified maximum holding time requirement. |
| M | <i>For CLP Analyses Only</i> -- Duplicate injection precision criterion was not met. |
| N | Matrix spike recovery exceeded acceptance limits. |
| S | Reported value was determined from the method of standard addition. |
| U | <i>For CLP Reporting Only</i> -- Constituent was analyzed for but not detected (sample quantitation must be corrected for dilution and percent moisture). |
| W | <i>For AAS Only</i> -- Post-digestion spike for Furnace AAS did not meet acceptance criteria and sample absorbance is less than 50% of spike absorbance. |
| X, Y, or Z | Analyst-defined qualifier. |
| * | Relative percent difference (RPD) for duplicate analysis exceeded acceptance limits. |
| + | Correlation coefficient (r) for the MSA is less than 0.995. |
| For Use on the QC Data Reporting Forms | |
| a¹ | The spike recovery and/or RPD for matrix spike and matrix spike duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration. |
| b¹ | The RPD cannot be computed because the sample and/or duplicate concentration was below the RDL. |

¹ Used as footnote designations on the QC summary form.

Lockheed Analytical Services
DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES

[Revised 08/28/92]

| For Use on the Analytical Data Reporting Forms | |
|---|---|
| B | Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or minimum detectable activity (MDA). |
| C | Presence of high TDS in sample required reduction of sample size which increased the MDA. |
| D | Constituent detected in the diluted sample. |
| E | Constituent concentration exceeded the calibration or attenuation curve range. |
| F | <i>For Alpha Spectrometry Only</i> -- FWHM exceeded acceptance limits. |
| H | Sample analysis performed outside of method-specified maximum holding time requirement. |
| Y | Chemical yield exceeded acceptance limits. |
| For Use on the QC Data Reporting Forms | |
| * | QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits. |
| a¹ | The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration. |
| b¹ | The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA. |

¹ Used as foot note designations on the QC summary form.

LOCKHEED ANALYTICAL SERVICES
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Jun 16 1995, 10:59 am

REVISION

Login Number: L4482
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

| Laboratory Sample Number | Client Sample Number | Collect Date | Receive Date | Due PR Date |
|---|--|-----------------|-----------------|----------------|
| L4482-1 TEMP 2 Location: EXPENDED Water 1 S SCREENING | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| Hold:05-NOV-95 | | | | |
| L4482-2 TEMP 2 Location: RFG01-7C Water 1 S CLP FURNACE Water 1 S CLP ICP Water 1 S CLP ICP-MS METALS | BOFKH6 "ICP METALS=Ca,Mg,Na,K,Fe,Mn,Si,Al,Bi,Se" | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| Hold:05-NOV-95 Hold:05-NOV-95 Hold:05-NOV-95 | | | | |
| L4482-3 TEMP 2 Location: RFG19-103C Water 1 S 300.0 CHLORIDE Water 1 S 300.0 FLUORIDE Water 1 S 300.0 NITRATE Water 1 S 300.0 NITRITE Water 1 S 300.0 PHOSPHATE Water 1 S 300.0 SULFATE | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| Hold:06-JUN-95 Hold:06-JUN-95 Hold:11-MAY-95 Hold:11-MAY-95 Hold:11-MAY-95 Hold:06-JUN-95 | | | | |
| L4482-4 TEMP 2 Location: RFG19-103C Water 1 S 310.1 ALKALINITY | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| Hold:23-MAY-95 | | | | |
| L4482-5 TEMP 2 Location: RFG19-127C Water 1 S 160.1 TDS | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| Hold:16-MAY-95 | | | | |
| L4482-6 TEMP 2 Location: RFG19-127C Water 1 S CLP CYANIDE | BOFKH6 "ICP METALS=Ca,Mg,Na,K,Fe,Mn,Si,Al,Bi,Se" | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| Hold:23-MAY-95 | | | | |
| L4482-7 TEMP 2 Location: RFG01-7C | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-8 TEMP 2 Location: 155 | BOFKH6 "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |

*ADDED CLP ICP-MS METALS (Bi) TO

L4482-2, -21

R.C. 6-16-95

012

2571596

LOCKHEED ANALYTICAL SERVICES
 LOGIN CHAIN OF CUSTODY REPORT (ln01)
 Jun 16 1995, 10:59 am

Login Number: L4482
 Account: 596 Bechtel Hanford, Inc. * Richland, WA
 Project: BECHTEL-HANFORD Bechtel Hanford Project

| Laboratory Sample Number | Client Sample Number | Collect Date | Receive Date | Due PR Date |
|-----------------------------|--|-----------------|-----------------|----------------|
| Water 1 | S GAMMA SPEC LAL-0063 | Hold:05-NOV-95 | | |
| Water 1 | S GR ALP/BETA LAL-0060 | Hold:05-NOV-95 | | |
| Water 1 | S PU-ISOTOPIC LAL-0108 | Hold:05-NOV-95 | | |
| Water 1 | S SR-90 LAL-0196 | Hold:05-NOV-95 | | |
| Water 1 | S U TOTAL KPA LAL-0168 | Hold:05-NOV-95 | | |
| L4482-9 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: 156H-A100 | | | | |
| L4482-10 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: 156V-045 | | | | |
| L4482-11 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: EXPENDED | | | | |
| L4482-12 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: 156V-045 | | | | |
| L4482-13 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: 156H-A100 | | | | |
| L4482-14 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: 156V-E032 | | | | |
| L4482-15 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: 156V-A035 | | | | |
| L4482-16 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | | | | |
| Location: 156-020 | | | | |
| Water 1 | S TRITIUM(H3) LAL-0066 | Hold:05-NOV-95 | | |
| L4482-17 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | | | | |
| Location: 156CART-4 | | | | |
| Water 1 | S TC-99 LAL-0169 | Hold:05-NOV-95 | | |

LOCKHEED ANALYTICAL SERVICES
 LOGIN CHAIN OF CUSTODY REPORT (ln01)
 Jun 16 1995, 10:59 am

Login Number: L4482
 Account: 596 Bechtel Hanford, Inc. * Richland, WA
 Project: BECHTEL-HANFORD Bechtel Hanford Project

| Laboratory Sample Number | Client Sample Number | Collect Date | Receive Date | Due PR Date |
|--|---|---|-----------------|----------------|
| L4482-18 TEMP 2 Location: 156H-A100 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-19 TEMP 2 Location: 156H-A100 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-20 TEMP 2 Location: 156H-A100 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-21 TEMP 2 Location: 133 Filt H2O 15 S CLP FURNACE Filt H2O 15 S CLP ICP Filt H2O 15 S CLP ICP-MS METALS | BOFKH7 "ICP METALS=Ca,Mg,Na,K,Fe,Mn,Si,Al,Bi,Se" | 09-MAY-95 Hold:05-NOV-95 Hold:05-NOV-95 Hold:05-NOV-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-22 Location: Water 1 S EDD - DISK DEL. Water 1 S INORG TYPE 2 RPT + Water 1 S RAD RPT TYPE 2 | REPORT TYPE | 11-MAY-95 | 11-MAY-95 | 15-JUN-95 |

Signature: _____

Date: _____ 014

0511596

LOGIN CHAIN OF CUSTODY REPORT (ln01)
May 11 1995, 10:31 am

Login Number: L4482
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

| Laboratory Sample Number | Client Sample Number | Collect Date | Receive Date | Due PR Date |
|--|-------------------------|-----------------|-----------------|----------------|
| L4482-1 TEMP 2 Location: 157 Water 1 S SCREENING | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| | | Hold:05-NOV-95 | | |
| L4482-2 TEMP 2 "ICP METALS=Ca,Mg,Na,K,Fe,Mn,Si,Al,Bi,Se" Location: 157 Water 1 S CLP FURNACE Water 1 S CLP ICP | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| | | Hold:05-NOV-95 | | |
| | | Hold:05-NOV-95 | | |
| L4482-3 TEMP 2 Location: 157 Water 1 S 300.0 CHLORIDE Water 1 S 300.0 FLUORIDE Water 1 S 300.0 NITRATE Water 1 S 300.0 NITRITE Water 1 S 300.0 PHOSPHATE Water 1 S 300.0 SULFATE | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| | | Hold:06-JUN-95 | | |
| | | Hold:06-JUN-95 | | |
| | | Hold:11-MAY-95 | | |
| | | Hold:11-MAY-95 | | |
| | | Hold:11-MAY-95 | | |
| | | Hold:06-JUN-95 | | |
| L4482-4 TEMP 2 Location: 157 Water 1 S 310.1 ALKALINITY | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| | | Hold:23-MAY-95 | | |
| L4482-5 TEMP 2 Location: 157 Water 1 S 160.1 TDS | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| | | Hold:16-MAY-95 | | |
| L4482-6 TEMP 2 "ICP METALS=Ca,Mg,Na,K,Fe,Mn,Si,Al,Bi,Se" Location: 157 Water 1 S CLP CYANIDE | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| | | Hold:23-MAY-95 | | |
| L4482-7 TEMP 2 Location: 157 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-8 TEMP 2 "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" Location: 157 Water 1 S GAMMA SPEC LAL-0063 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| | | Hold:05-NOV-95 | | |

LOGIN CHAIN OF CUSTODY REPORT (ln01)
May 11 1995, 10:31 am

Login Number: L4482
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

| Laboratory Sample Number | Client Sample Number | Collect Date | Receive Date | Due PR Date |
|-----------------------------|--|-----------------|-----------------|----------------|
| Water | 1 S GR ALP/BETA LAL-0060 | Hold:05-NOV-95 | | |
| Water | 1 S PU-ISOTOPIC LAL-0108 | Hold:05-NOV-95 | | |
| Water | 1 S SR-90 LAL-0196 | Hold:05-NOV-95 | | |
| Water | 1 S U TOTAL KPA LAL-0168 | Hold:05-NOV-95 | | |
| L4482-9 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: | 157 | | | |
| L4482-10 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: | 157 | | | |
| L4482-11 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: | 157 | | | |
| L4482-12 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: | 157 | | | |
| L4482-13 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: | 157 | | | |
| L4482-14 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: | 157 | | | |
| L4482-15 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | |
| Location: | 157 | | | |
| L4482-16 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | | | | |
| Location: | 157 | | | |
| Water | 1 S TRITIUM(H3) LAL-0066 | Hold:05-NOV-95 | | |
| L4482-17 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| TEMP 2 | | | | |
| Location: | 157 | | | |
| Water | 1 S TC-99 LAL-0169 | Hold:05-NOV-95 | | |

LOGIN CHAIN OF CUSTODY REPORT (ln01)
May 11 1995, 10:31 am

Login Number: L4482
Account: 596 Bechtel Hanford, Inc. * Richland, WA
Project: BECHTEL-HANFORD Bechtel Hanford Project

| Laboratory Sample Number | Client Sample Number | Collect Date | Receive Date | Due PR Date |
|--|---|---|-----------------|----------------|
| L4482-18 TEMP 2 Location: 157 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-19 TEMP 2 Location: 157 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-20 TEMP 2 Location: 157 | BOFKH6 | 09-MAY-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-21 TEMP 2 Location: 157 Filt H2O 15 S CLP FURNACE Filt H2O 15 S CLP ICP | BOFKH7 "ICP METALS=Ca,Mg,Na,K,Fe,Mn,Si,Al,Bi,Se" | 09-MAY-95 Hold:05-NOV-95 Hold:05-NOV-95 | 11-MAY-95 | 15-JUN-95 |
| L4482-22 Location: Water 1 S EDD - DISK DEL. Water 1 S INORG TYPE 2 RPT + Water 1 S RAD RPT TYPE 2 | REPORT TYPE | 11-MAY-95 | 11-MAY-95 | 15-JUN-95 |

Bechtel Hanford, Inc.

L4482

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

Page 1 of 1

Data Turnaround

☐ Priority
☒ Normal

| | | |
|---|--|--|
| Collector <i>K. Lee</i> | Company Contact G.L. Kasza | Telephone (509) 372-9675 |
| Project Designation 200-BP-5 Groundwater Round 3 | Sampling Location 200 East | SAF No. B95-049 |
| Ice Chest No. <i>SMC-371</i> | Field Logbook No. <i>2 FL 1129</i> | Method of Shipment Federal Express |
| Shipped To Lockheed | Offsite Property No. <i>W95-0-03041-029</i> | Bill of Lading/Air Bill No. <i>7404627844</i> |

| | | | | | | | | | | | |
|--|---------------------|--|------------|----------|----------|------|---------|----------|------------------|----------|------|
| Possible Sample Hazards/Remarks | Preservation | HNO3 | Cool 4°C | Cool 4°C | Cool 4°C | NaOH | HNO3 | Cool 4°C | HCl | Cool 4°C | HNO3 |
| | Type of Container | P/G | G | P | P | P | P/G | G | P | P | P/G |
| | No. of Container(s) | 1 | 1 | 1 | 1 | 2 | 8 | 1 | 4 | 1 | 1 |
| Special Handling and/or Storage Maintain samples between 2°C and 6°C. | Volume | 1L | 500mL | 250mL | 500mL | 1L | 1L | 500mL | 1L | 20mL | 1L |
| SAMPLE ANALYSIS | *1 | Anions (IC- F, Co, SO4, NO2, NO3, PO4 | Alkalinity | TDS | Cyanide | *2 | Tritium | Tc-99 | Activity Scan | *3 | |

| Sample No. | Matrix* | Date Sampled | Time Sampled | | | | | | | | | |
|------------|---------|--------------|--------------|---|---|---|---|---|---|---|---|---|
| B0FKH6 | U | 5-9-95 | 1102 | X | X | X | X | X | X | X | X | |
| B2FKH7 | U | 5-9-95 | 1102 | | | | | | | | | X |
| | | | | | | | | | | | | |
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| | | | |
|--|--|---|-------------------|
| CHAIN OF POSSESSION | Sign/Print Names | SPECIAL INSTRUCTIONS | Matrix* |
| Relinquished By <i>K. Lee</i> Date/Time <i>5/9/95 1400</i> | Received By <i>ERC</i> Date/Time <i>1400</i> | *1 ICP Metals - to include Ca, Mg, Na, K, Fe, Mn, Si, Al, and Bi. AA Metals - to include Se (unfiltered). | S = Soil |
| Relinquished By <i>ERC</i> Date/Time <i>0900</i> | Received By <i>Bwh.Haw</i> Date/Time <i>5-9-95</i> | *2 Gross Alpha; Gross Beta; Pu-238, -239/240; Sr-90; Gamma Spec - to include Cs-137, Co-60, Ru-106; Total Uranium. | SE = Sediment |
| Relinquished By <i>Bwh.Haw</i> Date/Time <i>5-10-95</i> | Received By | *3 ICP Metals - to include Ca, Mg, Na, K, Fe, Mn, Si, Al, and Bi. AA Metals - to include Se (filtered). | SO = Solid |
| Relinquished By | Received By | Sample analysis for PO4, NO2, NO3 by EPA 300.0 is being requested for information only. The ERC Contractor acknowledges that the 48-hour hold time will not be met. | SL = Skudge |
| Relinquished By | Received By | The Activity Scan is for both sample numbers listed on this chain of custody. | W = Water |
| | | | O = Oil |
| | | | A = Air |
| | | | DS = Drum Solids |
| | | | DL = Drum Liquids |
| | | | T = Tissue |
| | | | WI = Wipe |
| | | | L = Liquid |
| | | | V = Vegetation |
| | | | XI = Other |

| | |
|--------------------------|--|
| LABORATORY SECTION | Received By <i>h. Miller</i> Title <i>Sample Custodian</i> Date/Time <i>5-11-95 / 0845</i> |
| FINAL SAMPLE DISPOSITION | Disposal Method <i>Disposed By</i> Date/Time |

WHC/BHI SAMPLE CHECK-IN LIST

Date/Time Received: 5-11-95 / 9:00 AM SDG #: 1114

Work Order Number: 1112 SAF #: B95-049

Shipping Container ID: 5mL-371 Chain of Custody # 1112

1. Custody Seals on shipping container intact? Yes ☒ No ☐
2. Custody Seals dated and signed? Yes ☒ No ☐
3. Chain-of-Custody record present? Yes ☒ No ☐
4. Cooler temperature 28
5. Vermiculite/packing materials is Wet ☐ Dry ☒
6. Number of samples in shipping container: 21
7. Sample holding times exceeded: Yes ☒ No ☐
8. Samples have: tape hazard labels
X custody seals appropriate sample labels
9. Samples are: X in good condition leaking
 broken have air bubbles
10. Were any anomalies identified in sample receipt? Yes ☐ No ☒
11. Description of anomalies (include sample numbers): 1114

Sample Custodian: Paul C Davis On: 5-11-95 / 9:00 AM

Telephoned To: Kathleen Hall On 5-11-95 / 9:00 AM By Paul Sturges

Sample Login

Login Review Checklist

Lot Number 4482

The login review should be conducted by that person logging in the samples as well as a peer. Please use this checklist to ensure that such reviews occur in a uniform basis. Please sign and date below to verify that a login review has occurred. This checklist should be affixed to each login package prior to distribution.

For an effective login review, as a minimum, five reports from the login process are required. These are the chain of custody (or equivalent), the login chain of custody report, the sample summary report, the sample receiving checklist, and the login quotation. Before beginning a review, ensure that these five components are available. For jobs with single component samples, the sample summary report may be omitted.

Sample Summary Report

Yes No

N/A

- | | | | | |
|----|--|----------|---|---|
| 1. | Are all sample IDs correct? | <u>X</u> | — | — |
| 2. | Are all samples present? | <u>X</u> | — | — |
| 3. | Are all matrices correct? (e.g., TCLP analyses should be on a TCLP leachate, field blanks should be water) | <u>X</u> | — | — |
| 4. | Are all analyses on the chain of custody/login quotation included? | <u>X</u> | — | — |
| 5. | Are analyses logged in for the correct container? (e.g., analyses requiring preservation logged in for a preserved container and vice versa) | <u>X</u> | — | — |
| 6. | Are samples logged in according to laboratory batching procedures? (e.g., TCLP regular leaching and associated metals/semivolatile organics should be logged in on the same bottle) | <u>X</u> | — | — |

Login Chain of Custody Report

- | | | | | |
|----|---|----------|---|---|
| 1. | Are the Collect, Receive, and Due dates correct for every sample? | <u>X</u> | — | — |
| 2. | Have appropriate sample comments been included? (e.g., MS/MSD designation, comments from the client concerning method modifications) | <u>X</u> | — | — |

Sample Receiving Checklist

- | | | | | |
|----|--|--|--|--|
| 1. | Are any discrepancies between the chain of custody and the login noted? — <u>12/7</u> (e.g., client IDs different on chains of custody and bottle labels, samples not sent, samples lost from breakage) | | | |
|----|--|--|--|--|

Frank Davis

5-11-95

M. Miller

5-11-95

Primary review signature

Date

Secondary review signature

Date

Lockheed Analytical Services Sample Receiving Checklist

Client Name: *NPST House - Hantford*

Job No. *L4482*

Cooler ID: *117*

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: *22*

temperature of temp. blank upon receipt: *-*

| | Yes | No | * Comments/Discrepancies |
|-------------------------------------|----------|----|--------------------------|
| custody seals intact | <i>X</i> | | |
| chain of custody present | <i>X</i> | | |
| blue ice (or equiv.) present/frozen | <i>X</i> | | |
| rad survey completed | <i>X</i> | | |

SAMPLE CONDITION UPON RECEIPT

| | Yes | No | * Comments/Discrepancies |
|--|----------|--------------|--------------------------|
| all bottles labeled | <i>X</i> | | |
| samples intact | <i>X</i> | | |
| proper container used for sample type | <i>X</i> | | |
| sample volume sufficient for analysis | <i>X</i> | | |
| proper pres. indicated on the COC | <i>X</i> | | |
| VOA's contain headspace | | <i>11/11</i> | |
| are samples bi-phasic (if so, indicate sample ID'S): | | <i>0119</i> | |

MISCELLANEOUS ITEMS

| | Yes | No | * Comments/Discrepancies |
|----------------------------------|----------|--------------|----------------------------|
| samples with short holding times | <i>X</i> | | <i>21712.12 / 21712.12</i> |
| samples to subcontract | | <i>11/11</i> | |

ADDITIONAL COMMENTS/DISCREPANCIES

Completed by / date: *Paul C. Jones 5-11-95*

Sent to the client (date/initials):

** Client's signature upon receipt:

Notes: * = contact the appropriate CSR of any discrepancies immediately upon receipt

** = please review this information and return via facsimile to the appropriate CSR (702) 361-8146

Environmental
Restoration
Contractor

ERC Team
Interoffice Memorandum

Job No. 22192
Written Response Required: NO
CCN: N/A
OU: 200-BP-5
TSD: N/A
ERA: N/A
Subject Code: 1995 Round 3 Sampling

TO: W. S. Thompson N3-06 DATE: April 21, 1995
COPIES: D. B. Erb H6-01 FROM: S. K. De Mers
Radiological Controls
N3-06/376-2764
SUBJECT: 1995 Round 3 sampling for 200-BP-5

There is no need to perform total activities prior to offsite shipment to NRC licensed labs of samples taken from the attached list of wells.

The wells listed in the attachment were reviewed for radiological content based on the previous 4 years of sampling data. No well listed has a β activity in excess of 100,000 pCi/l ($< .1$ uCi/sample based on a 1 liter sample size) nor any α activity in excess of 10,000 pCi/l ($< .01$ uCi/l based on a 1 liter sample). All wells show activities $< 2,000$ pCi/gm (< 2 nCi/gm D.O.T. limit). The highest activity in recent samples is 17,000 pCi/l β and 170 pCi/l α .

Radiological monitoring during sampling will only be required if the wells are located in radiological areas or if the wells themselves are labeled with radiological stickers. Monitoring requirements for down hole work such as pump removal will be determined based on the history of each well on a case by case basis.

skd

DISSOLVED METALS RESULTS

| | | |
|--------------------------|--------------------------|------------------------|
| Client Sample ID: BOFKH7 | Date Collected: 05-09-95 | Matrix: filtered water |
| LAL Batch ID(s): 511 bhD | Date Received: 05-11-95 | |

| Constituents | Method | Concentration (mg/L) | IDL (mg/L) | RDL (mg/L) | Data Qualifier(s) | Date Analyzed | LAL ID |
|--------------|--------|----------------------|------------|------------|-------------------|---------------|----------|
| Aluminum | CLP | <0.057 | 0.057 | 0.20 | U | 06-16-95 | L4482-21 |
| Bismuth | CLP | 0.0014 | 0.001 | 0.005 | B N | 06-28-95 | L4482-21 |
| Calcium | CLP | 34 | 0.056 | 5.0 | | 06-16-95 | L4482-21 |
| Iron | CLP | 0.019 | 0.010 | 0.10 | B | 06-16-95 | L4482-21 |
| Magnesium | CLP | 10 | 0.057 | 5.0 | | 06-16-95 | L4482-21 |
| Manganese | CLP | <0.002 | 0.002 | 0.015 | U | 06-16-95 | L4482-21 |
| Potassium | CLP | 8.2 | 0.363 | 5.0 | | 06-16-95 | L4482-21 |
| Selenium | CLP | <0.003 | 0.003 | 0.005 | W | 06-17-95 | L4482-21 |
| Silicon | CLP | 26 | 0.012 | 0.10 | | 06-22-95 | L4482-21 |
| Sodium | CLP | 23 | 0.041 | 5.0 | | 06-16-95 | L4482-21 |

Comments:

TOTAL METALS RESULTS

| | | |
|--------------------------|--------------------------|---------------|
| Client Sample ID: BOFKH6 | Date Collected: 05-09-95 | Matrix: water |
| LAL Batch ID(s): 511 bhT | Date Received: 05-11-95 | |

| Constituents | Method | Concentration (mg/L) | IDL (mg/L) | RDL (mg/L) | Data Qualifier(s) | Date Analyzed | LAL ID |
|--------------|--------|----------------------|------------|------------|-------------------|---------------|---------|
| Aluminum | CLP | <0.057 | 0.057 | 0.20 | U | 06-20-95 | L4482-2 |
| Bismuth | CLP | <0.001 | 0.001 | 0.005 | U | 06-28-95 | L4482-2 |
| Calcium | CLP | 34 | 0.056 | 5.0 | | 06-20-95 | L4482-2 |
| Iron | CLP | 0.17 | 0.010 | 0.10 | | 06-20-95 | L4482-2 |
| Magnesium | CLP | 10 | 0.057 | 5.0 | | 06-20-95 | L4482-2 |
| Manganese | CLP | <0.002 | 0.002 | 0.015 | U | 06-20-95 | L4482-2 |
| Potassium | CLP | 8.8 | 0.363 | 5.0 | | 06-20-95 | L4482-2 |
| Selenium | CLP | <0.003 | 0.003 | 0.005 | W | 06-19-95 | L4482-2 |
| Silicon | CLP | 28 | 0.012 | 0.10 | | 06-22-95 | L4482-2 |
| Sodium | CLP | 24 | 0.041 | 5.0 | | 06-20-95 | L4482-2 |

Comments:

LOCKHEED ANALYTICAL SERVICES

Sample Results

| | |
|--------------------------|---------------------------|
| Client Sample ID: BOFKH6 | Date Collected: 09-MAY-95 |
| Matrix: Water | Date Received: 11-MAY-95 |
| Percent Solids: N/A | |

| Constituent | Units | Method | Result | Project Reporting Limit | Data Qualifier(s) | Date Analyzed | LAS Batch ID | LAS Sample ID |
|------------------------------|-------|--------|---------|-------------------------|-------------------|---------------|--------------|---------------|
| Total Dissolved Solids | mg/L | 160.1 | 280 | 40. | | 16-MAY-95 | 22839 | L4482-5 |
| Chloride | mg/L | 300.0 | 8.5 | 0.020 | | 11-MAY-95 | 22732 | L4482-3 |
| Fluoride | mg/L | 300.0 | 0.33 | 0.10 | | 11-MAY-95 | 22737 | L4482-3 |
| Nitrate-N | mg/L | 300.0 | 11. | 0.020 | | 11-MAY-95 | 22733 | L4482-3 |
| Nitrite-N | mg/L | 300.0 | < 0.002 | 0.010 | U | 11-MAY-95 | 22734 | L4482-3 |
| Ortho Phosphate | mg/L | 300.0 | < 0.020 | 0.10 | U | 11-MAY-95 | 22736 | L4482-3 |
| Sulfate | mg/L | 300.0 | 16. | 0.10 | | 11-MAY-95 | 22735 | L4482-3 |
| Alkalinity, total (as CaCO3) | mg/L | 310.1 | 110 | 30. | | 16-MAY-95 | 22859 | L4482-4 |
| Bicarbonate Alka as CaCO3 | mg/L | 310.1 | 110 | 30. | | 16-MAY-95 | 22859 | L4482-4 |
| Carbonate Alka as CaCO3 | mg/L | 310.1 | < 10. | 30. | U | 16-MAY-95 | 22859 | L4482-4 |
| Total Cyanide | mg/L | CLP | 0.034 | 0.020 | D(1:2) | 16-MAY-95 | 22874 | L4482-6 |

Lockheed Analytical Laboratory
SAMPLE SUMMARY REPORT (su02)
Bechtel Hanford, Inc. * Richland, WA

| Client Sample Number | LAL Sample Number | SDG Number | Matrix | Method |
|-------------------------|----------------------|---------------|-------------------|-------------------|
| BOFKH6 - | L4482-1 | | Water | SCREENING - |
| | L4482-2 | | Water | CLP FURNACE - |
| | L4482-2 | | Water | CLP ICP - |
| | L4482-3 | | Water | 300.0 CHLORIDE - |
| | L4482-3 | | Water | 300.0 FLUORIDE - |
| | L4482-3 | | Water | 300.0 NITRATE - |
| | L4482-3 | | Water | 300.0 NITRITE - |
| | L4482-3 | | Water | 300.0 PHOSPHATE |
| | L4482-3 | | Water | 300.0 SULFATE - |
| | L4482-4 | | Water | 310.1 ALKALINITY |
| | L4482-5 | | Water | 160.1 TDS - |
| | L4482-6 | | Water | CLP CYANIDE - |
| | L4482-8 | | Water | GAMMA SPEC LAL - |
| | L4482-8 | | Water | GR ALP/BETA LAL - |
| | L4482-8 | | Water | PU-ISOTOPIC LAL - |
| | L4482-8 | | Water | SR-90 LAL-0196 - |
| | L4482-8 | | Water | U TOTAL KPA LAL - |
| L4482-16 | | Water | TRITIUM(H3) LAL - | |
| L4482-17 | | Water | TC-99 LAL-0169 - | |
| BOFKH7 - | L4482-21 | | Filt H2O | CLP FURNACE - |
| | L4482-21 | | Filt H2O | CLP ICP - |
| REPORT TYPE - | L4482-22 | | Water | EDD - DISK DEL - |
| | L4482-22 | | Water | INORG TYPE 2 RPT |
| | L4482-22 | | Water | RAD RPT TYPE 2 |

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0FKH6

LAL Sample ID: L4482-8

Date Collected: 09-MAY-95

Date Received: 11-MAY-95

Matrix: Water

Login Number: L4482

SDG: LK4482

| Constituent | Analyzed | Batch | Activity | Error | MDA | Background | Units |
|-----------------------|-----------|----------------------------|----------|-------|------|------------|-------|
| Ac-228(Ra-228) | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 9. | 26. | 41. | | pCi/L |
| Co-58 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 2.7 | 5.1 | 8.6 | | pCi/L |
| Co-60 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 24.4 | 7.9 | 8.9 | | pCi/L |
| Cs-137 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -7.2 | 4.0 | 12. | | pCi/L |
| Eu-152 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -13. | 13. | 49. | | pCi/L |
| Eu-154 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -3. | 13. | 34. | | pCi/L |
| Eu-155 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -2.6 | 6.4 | 19. | | pCi/L |
| Fe-59 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 1.9 | 8.7 | 19. | | pCi/L |
| Pb-212 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 5. | 12. | 16. | | pCi/L |
| Pb-214(Ra-226) | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 12. | 13. | 18. | | pCi/L |
| Ra-226(GAMMA) | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -100 | 130 | 190 | | pCi/L |
| Ru-106 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 10. | 43. | 73. | | pCi/L |
| U-235(GAMMA) | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -7. | 30. | 44. | | pCi/L |
| Gross Alpha | 12-JUN-95 | GR ALP/BETA LAL-0060_23215 | 2.8 | 2.0 | 2.7 | C | pCi/L |
| Gross Beta | 12-JUN-95 | GR ALP/BETA LAL-0060_23215 | 883. | 46. | 3.1 | | pCi/L |
| Pu-238 | 12-JUN-95 | PU-ISOTOPIC LAL-0108_23154 | -0.035 | 0.034 | 0.19 | | pCi/L |
| Pu-239/40 | 12-JUN-95 | PU-ISOTOPIC LAL-0108_23154 | 0.05 | 0.12 | 0.19 | | pCi/L |
| Total radio-strontium | 09-JUN-95 | SR-90 LAL-0196_23179 | -0.21 | 0.42 | 0.75 | | pCi/L |
| Uranium | 09-JUN-95 | U TOTAL KPA LAL-0168_23131 | 3.31 | 0.17 | 0.20 | | ug/L |

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0FKH6

LAL Sample ID: L4482-16

Date Collected: 09-MAY-95

Date Received: 11-MAY-95

Matrix: Water

Login Number: L4482

| Constituent | Analyzed | Batch | Activity | Error | MBA | DataQual | Units |
|-------------|-----------|----------------------------|----------|-------|-----|----------|-------|
| H-3 | 26-MAY-95 | TRITIUM(H3) LAL-0066_23181 | 360 | 220 | 260 | | pci/L |

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0FKH6

LAL Sample ID: L4482-17

Date Collected: 09-MAY-95

Date Received: 11-MAY-95

Matrix: Water

Login Number: L4482

| Constituent | Analyzed | Batch | Activity | Error | MDA | DataQual | Units |
|-------------|-----------|----------------------|----------|-------|-----|----------|-------|
| Tc-99 | 31-MAY-95 | TC-99 LAL-0169_23139 | 1560 | 130 | 7.1 | | pCi/L |

PROJECT Gross Alpha/Beta LCS

Continued From Page _____

SECONDARY / WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information

Isotope: Am-241 And Sr-90

From NIST traceable standard?: Yes

Vendor or Certificate I.D. # of parent standard: Am-241 FPL-388-100-1
Sr-90 NIST SRM 4919G

Diluted source logbook I.D. #: Am-241 91-0225-60-1
Sr-90 91-0225-30-2

Balance verification?: Yes

Diluent used: 0.1 N HNO₃

Dilution

*Diluent: 0.1 N HNO₃ + 42mg Sr(NO₃)₂/mL

*Density of diluent (g/ml): NA

a. Parent standard activity: Am-241 9810 pCi/mL
Sr-90 6000 pCi/mL on 8/1/90

b. Amount of standard transferred: Am-241 0.5 mL
Sr-90 0.5 mL

c. Total amount of dilution: 500 mL

d. Activity of dilution [a * b / c]: Am-241 9.81 pCi/mL
Sr-90 6.0 pCi/mL on 8/1/90
10.4 pCi/mL on 8/1/94

Dilution logbook I.D. #: 93-0474-94

Prepared by: Joe HatcherPreparation date: 8/16/94Reviewed by: James WongReview date: 8^{AW} 10-4-94

*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

LAL-91-SOP-0174

Read and Understood By



Signed

3/20/95

Date

Signed

Date

131

S 12. Diluted to 10 ml to make 91-0225-60-1 AA0030 ✓

CERTIFICATE OF CALIBRATION ALPHA STANDARD SOLUTION

| | | | | |
|--------------|-------------------|--------------------------|-------------------------------------|------------|
| Radionuclide | Am-241 | Customer: | LOCKHEED ENGINEERING & SCIENCES Co. | |
| Half Life: | 432.7 ± 0.5 years | P.O.No.: | 06LAB1245 | |
| Catalog No.: | 7241 | Reference Date: | November 1 1991 | 12:00 PST. |
| Source No.: | 388-100-1 | Contained Radioactivity: | 0.997 | μCi. |

Description of Solution

| | | |
|----------------------|-------------------------------|-----------------|
| a. Mass of solution: | 5.0007 | grams. |
| b. Chemical form: | AmCl ₃ in 0.5N HCl | |
| c. Carrier content: | None added | |
| d. Density: | 1.0077 | gram/ml @ 20°C. |

Radioimpurities

None detected

Radioactive Daughters

None detected

Radionuclide Concentration

0.1994 μCi/gram.

Method of Calibration

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

Uncertainty of Measurement

| | |
|--|-------|
| a. Systematic uncertainty in instrument calibration: | ±2.0% |
| b. Random uncertainty in assay: | ±0.7% |
| c. Random uncertainty in weighing(s): | ±0.0% |
| d. Total uncertainty at the 99% confidence level: | ±2.7% |

NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

Notes

1. Nuclear data were taken from "Table of Isotopes", Seventh Edition, edited by Virginia S. Shirley.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)



ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone Street,
Burbank, California 91504
(818) 843 - 7000

Ray A. Moore
QUALITY CONTROL



THIS IS A PHOTOCOPY OF THE CERTIFICATE
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SEPARATE COVER.

AA0046

National Institute of Standards & Technology

Certificate

Standard Reference Material 4919-G Radioactivity Standard

| | |
|------------------------------------|---|
| Radionuclide | Strontium-90 |
| Source identification | 4919-G |
| Source description | Solution in NIST borosilicate-glass ampoule ⁽¹⁾ * |
| Solution composition | Strontium-90 plus yttrium-90 plus approximately 95 μg each of non-radioactive strontium and yttrium per gram of 1-molar hydrochloric acid ⁽²⁾ |
| Mass | Approximately 5.0 grams |
| Radioactivity concentration | $4.514 \times 10^3 \text{ Bq g}^{-1}$ |
| Reference time | 1200 EST August 1, 1990 |
| Overall uncertainty | 1.05 percent ⁽³⁾ |
| Photon-emitting impurities | None observed ⁽⁴⁾ |
| Alpha-particle-emitting impurities | None observed ⁽⁵⁾ |
| Half life | $28.5 \pm 0.2 \text{ years}$ ⁽⁶⁾ |
| Measuring instrument | $4\pi\beta$ liquid-scintillation counter |

This standard reference material was prepared in the Center for Radiation Research, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD 20899
January, 1991

William P. Reed, Acting Chief
Office of Standard Reference Materials

*Notes on back

NOTES

- (1) Approximately five milliliters of solution. Ampoule specifications:

| | |
|----------------------|------------------------|
| body diameter | 16.5 ± 0.5 mm |
| wall thickness | 0.60 ± 0.04 mm |
| barium content | less than 2.5 percent |
| lead oxide content | less than 0.02 percent |
| other heavy elements | trace quantities |

- (2) Solution density is 1.014 ± 0.002 g/mL at 21.5 °C.

- (3) The overall uncertainty was formed by taking three times the quadratic combination of standard deviations of the mean, or approximations thereof, for the following:

| | |
|--------------------------------------|--------------|
| a) liquid-scintillation measurements | 0.01 percent |
| b) gravimetric measurements | 0.05 percent |
| c) dead time | 0.10 percent |
| d) background | 0.01 percent |
| e) detection efficiency | 0.30 percent |
| f) decay-scheme data | 0.10 percent |
| g) half life | 0.01 percent |
| h) radionuclidic impurities | 0.10 percent |

- (4) The limit of detection for photon-emitting impurities is:

$$0.01 \text{ } \gamma \text{ s}^{-1} \text{ g}^{-1} \text{ between 50 and 1900 keV.}$$

- (5) The limit of detection for alpha-particle-emitting impurities is:

$$0.05 \text{ } \alpha \text{ s}^{-1} \text{ g}^{-1}.$$

- (6) NCRP Report No. 58, 2nd Edition, February 1985, p. 365.

For further information please contact Dr. Larry Lucas at (301) 975-5546.

NOTES ON THE USE OF STANDARD REFERENCE MATERIAL 4919G, STRONTIUM-90

The activity of the strontium-90 in the ampoule is given per gram of solution. If transfers are made by volume, the density given on the certificate can be used to compute the activity per unit volume. The activity given is the strontium-90 activity only. Because the strontium-90 is in equilibrium with its yttrium-90 daughter, which is also a beta-particle emitter, the activity given should be doubled to get the corresponding total beta-particle-emission rate.

If the solution is to be used for making quantitative sources, it should be kept tightly sealed so that evaporation, and the consequent change in the radioactivity concentration, is minimized. Glass containers are best for storage.

Dilute solutions of strontium-90 are often assayed by liquid-scintillation counting. We recommend that carrier solution containing approximately 1 mg of non-radioactive strontium be added first to the liquid-scintillation cocktail. We typically use a carrier solution containing 4 mg of strontium per mL of 0.5- molar hydrochloric acid. When 0.25 mL of this solution is added to 10 mL of emulsion-type liquid-scintillation cocktail, the resulting 1 mg of strontium per vial is generally sufficient to prevent the radioactive strontium-90 from plating out on the vial walls. A set of liquid-scintillation vials that cover a range of sample-solution masses should be prepared and monitored over several days to ensure that the efficiency is constant.

The beta-particle counting efficiency will be somewhat less than unity. A correction for the loss of low-energy beta particles can be computed using the integral-discriminator-extrapolation technique (G. Goldstein, *Nucleonics* 23 (1965) 67) or using the liquid-scintillation efficiency-tracing technique with tritium (B.M. Coursey et al, *Int. J. Radiat. Isotopes* 37 (1986) 403).

The activity concentration given on the certificate is as of 1200 hours Eastern Standard Time, August 9, 1990. To convert from EST to your local time, the table given below can be used.

TO CONVERT FROM EST TO:

| | | |
|------------|--------------------|----------------|
| EDT | Add | 1 hour |
| CDT | Same as EST | |
| CST | Subtract | 1 hour |
| MST | Subtract | 1 hour |
| MT | Subtract | 2 hours |
| PDT | Subtract | 2 hours |
| PST | Subtract | 3 hours |
| UTC | Add | 5 hours |

5/26/95
Dore

WORK GROUP REPORT (wk02)

May 22 1995, 11:01 am

Work Group: PU-ISOTOPIC LAL-0108_23154 for Department: 12 Radiation Prep.

Created: 22-MAY-95 Due: 22-MAY-95 Operator:

| Sample | Account Name | ClientID | C Product | Matrix | Stat | UA | Workdate | PR | Location |
|-----------|---|-------------------|------------------------|--------|------|----|-----------|----|-----------|
| Page 1 | | | | | | | | | |
| 23154DUP1 | DUP | L4482-B | S PU-ISOTOPIC LAL-0108 | Water | WIP | U | 22-MAY-95 | | |
| 23154LCS1 | LCS | Lab. Ctrl. Sample | S PU-ISOTOPIC LAL-0108 | Water | WIP | U | 22-MAY-95 | | |
| 23154MBB1 | MB | Method Blank | S PU-ISOTOPIC LAL-0108 | Water | WIP | U | 22-MAY-95 | | |
| L4482-B | Bechtel Hanford, Inc. | BOFKH6 | S PU-ISOTOPIC LAL-0108 | Water | WIP | U | 15-JUN-95 | | 156CART-2 |
| Comments: | | | | | | | | | |
| L4482-B | TEMP 2 "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | | | | | | |
| 9 | 156H-A100 | | | | | | | | |
| 10 | 156V B031 | | | | | | | | |
| 11 | AD33 | | | | | | | | |
| 12 | 35 | | | | | | | | |

✓

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory-Las Vegas
Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide

PLUTONIUM-239

Half-life

2.4×10^4 years

Nominal activity

59

nano curies

Nominal volume

5

ml in ampoule/bottle number

2510-1

Measurement Activity of principal radionuclide

Activity per gram of this solution

11.8

nano curies

of

Plutonium-239

at 0400 hours PST on

December 13, 1990

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

curies

Per gram

of the daughter nuclide

Total mass of this solution

APPROX. 5.0

grams

Method of measurement

The activity of the primary solution was measured
by an internal gas flow proportional counter.

The activity of the dilution was measured by
liquid scintillation counting.

Useful Life

This radionuclide has decayed through

half lives since it was obtained by EML-LV

We recommend that this solution should not be used after

Purity

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be:

| | | | |
|-----------------|-----------------------|---|---------------------------|
| (1) see remarks | less than equal to | % | of the principal activity |
| (2) | less than equal to | % | of the principal activity |
| (3) | less than equal to | % | of the principal activity |

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

Random Errors

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than $\pm 0.13\%$

(The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the student t factor for the degree of freedom ($n-1$)).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ($+\delta - \delta'$). These have been estimated not to exceed

$\pm 2.7\%$ or -2.7%

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error [$t(sm)$] at the 99.7% confidence limits and the worst case estimate of the systematic errors ($+\delta, -\delta'$)

The overall uncertainty is therefore calculated on the basis of $+[t(sm)+\delta] - [t(sm)-\delta']$ and is $\pm 3.1\%$ of the quoted radioactive concentration.

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Plutonium-239 and impurities were assumed to decay 100 percent by alpha emission.

Chemical Composition of Solution

Carrier content per gram of solution:

Other components:

4M Nitric acid

Preservative:

Remarks

| | | | |
|-------------|--------|------------------------|-----------------------|
| | Pu-238 | 0.033% | of the total activity |
| | Pu-240 | $4.6 \times 10^{-5}\%$ | of the total activity |
| IMPURITIES: | Pu-241 | $1.5 \times 10^{-3}\%$ | of the total activity |
| | Pu-242 | $8.8 \times 10^{-6}\%$ | of the total activity |
| | Pu-244 | $6.2 \times 10^{-9}\%$ | of the total activity |

155

Date Certificate Prepared December 13, 1990

Approval Signature

Paul B. T. Nahn

Friction

PRIMARY DILUTION: ~~Prepared by volume~~ *AW*

Dilution Log Book ID: 91-199-53 (91-225-271)
transferred to ↗

Reviewed by: AB Date: 5/4/93

SECONDARY/WORKING LEVEL
STANDARD DILUTION RECORD

Dilution Source Information

Isotope:

Pu-239

Parent Barcode Number

7A0029

Vendor or Certificate I.D. # of Parent Standard:

EPA 2510 - 1

Diluted Source Logbook I.D. #:

91-225-27-1

Balance Verification?:

yes

Diluent Used:

4M HNO₃

Dilution

*Diluent:

4M HNO₃

*Density of diluent (g/ml):

N/A

g/ml

a: Parent Specific Activity:

661.71

pCi/g

pCi/ml

b: Amount of Source Transferred:

1.7491

g

c: Total amount of Dilution:

115.89

g

d: Total Volume of Dilution:

N/A

ml

e: Activity of Dilution (a * b / c):

N/A

pCi/g

f: Activity of Dilution (a * b / d):

9.99

pCi/ml

Dilution Logbook I.D. #:

1-21-95 64

94-617-31-1

Prepared By:

James Wong

Preparation Date:

1-21-95

Reviewed By:

Joe Hittman

Review Date:

1/26/95

*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Read and Understood By

Signed

Date

Signed

Date



Rec. 19 Aug 93

National Institute of Standards & Technology

Certificate

THIS IS A PHOTOCOPY OF THE CERTIFICATE
WHICH IS BEING MAILED TO YOU UNDER
SEPARATE COVER.

Standard Reference Material 4334E
Radioactivity Standard

| | |
|---------------------------------------|---|
| Radionuclide | Plutonium-242 |
| Source identification | 4334E |
| Source description | Liquid in flame-sealed NIST borosilicate-glass ampoule ^{(1)*} |
| Solution mass | Approximately 5.8 grams |
| Solution composition | Plutonium-242 in <u>5 mol·L⁻¹ nitric acid</u> ⁽²⁾ |
| Reference time (Purification time) | 1200 EST, 18 December 1989 |
| Radioactivity concentration | 26.37 Bq·g ⁻¹ |
| Overall uncertainty | 1.12 percent ⁽³⁾ |
| Radionuclidic impurities | See Table 1 ⁽⁴⁾ |
| Half life | $(3.733 \pm 0.012) \times 10^4$ years ⁽⁵⁾ |
| Measuring instrument | Two 4 π liquid-scintillation counters, a calibrated germanium detector system, and a silicon surface-barrier detector |

This standard reference material was prepared in the Physics Laboratory, Ionizing Radiation Division,
Radioactivity Group, J.M. Robin Hutchinson, Acting Group Leader.

Gaithersburg, MD
January 1993

William P. Reed, Chief
Standard Reference Materials Program

*Notes on back



National Institute of Standards & Technology

Certificate

THIS IS A PHOTOCOPY OF THE CERTIFICATE
WHICH IS BEING MAILED TO YOU UNDER
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Gaithersburg, MD
January 1993

William P. Reed, Chief
Standard Reference Materials Program

*Notes on back

NOTES

- (1) Approximately five milliliters of solution. Ampoule specifications:

| | |
|----------------------|------------------------|
| body diameter | 16.5 ± 0.5 mm |
| wall thickness | 0.60 ± 0.04 mm |
| barium content | less than 2.5 percent |
| lead oxide content | less than 0.02 percent |
| other heavy elements | trace quantities |

- (2) Solution density is 1.170 ± 0.001 g·mL⁻¹ at 21.65 °C.

- (3) The overall uncertainty was formed by taking three times the quadratic combination of the standard deviations of the mean, or approximations thereof, for the following:

| | |
|--|--------------|
| a) alpha-particle-emission-rate measurements | 0.02 percent |
| b) background | 0.03 percent |
| c) livetime | 0.05 percent |
| d) detection efficiency | 0.25 percent |
| e) count-rate-vs-energy extrapolation to zero energy | 0.25 percent |
| f) half life | 0.00 percent |
| g) gravimetric measurements | 0.10 percent |
| h) radionuclidic impurities | 0.00 percent |

- (4) Values for ²³⁸Pu + ²⁴¹Am and for ²³⁹Pu + ²⁴⁰Pu were calculated based upon measurements performed at the Lawrence Livermore National Laboratory (LLNL) shortly after purification of the ²⁴²Pu in December of 1989. Values for ²³⁹Pu + ²⁴⁰Pu and for ²⁴¹Pu were calculated based upon measurements performed at the National Institute of Standards and Technology (NIST) in August of 1990.

- (5) Evaluated Nuclear Structure Data File (ENSDF), February 1990.

For further information please contact Dr. Larry Lucas at NIST.

Telephone: (301) 975-5546

FAX: (301) 926-7416

TABLE 1

| RELATIVE ACTIVITY OF RADIONUCLIDIC IMPURITIES AT REFERENCE TIME 1200 EST, 18 DECEMBER 1989 ^(a) | | | |
|--|------------------------------|--|--|
| RADIONUCLIDE | HALF LIFE (YEARS) | RELATIVE ACTIVITY AS DETERMINED BY | |
| | | LLNL | NIST |
| ²³⁸ Pu | 87.74 ± 0.04 ^(b) | ²³⁸ Pu + ²⁴¹ Am <0.000 025 ^(c) | ----- |
| ²³⁹ Pu | 24119 ± 26 ^(b) | | |
| ²⁴⁰ Pu | 6570 ± 6 ^(b) | ²³⁹ Pu + ²⁴⁰ Pu <0.000 005 ^(c) | ²³⁹ Pu + ²⁴⁰ Pu <0.000 043 ^(c) |
| ²⁴¹ Pu | 14.35 ± 0.10 ^(b) | ----- | 0.162 ± 0.002(1σ) ^(d) |
| ²⁴² Pu | 373300 ± 1200 ^(b) | 1.000 000 | 1.000 000 = |
| ²⁴¹ Am | 432.2 ± 0.5 ^(b) | ²³⁸ Pu + ²⁴¹ Am <0.000 025 ^(c) | 0.000 000 assumed |

^(a) Reference time is the time of purification of the plutonium-242.

^(b) Evaluated Nuclear Structure Data File (ENSDF), February 1990.

^(c) Using alpha-particle spectrometry, no alpha-particle emission was detected that could reliably be ascribed to these radionuclides. The value shown is an estimated upper limit based upon background and counting statistics.

^(d) The plutonium-241 relative activity at reference time was calculated from a gamma-ray measurement of the americium-241 ingrowth as of 18 August 1990.



Dear Customer:

The Standard Reference Material(s) (SRM'(s)) for which you have requested a Material Safety Data Sheet (MSDS), 4334E, Pu-242 is excluded from coverage in our regular MSDS system of more than 100 sheets for one or more of the following reasons:

- 1 ☐ The SRM is an article, as that word is defined in paragraph (c) of section 1910.1200 of title 29 of the Code of Federal Regulations which does not release or otherwise result in exposure to a hazardous chemical, under normal conditions of use.
- 2 ☐ The SRM has been determined to be non-hazardous by the National Institute of Standards and Technology under paragraph (d) of section 1910.1200 of title 29 of the Code of Federal Regulations. The SRM will not release or otherwise result in exposure to a hazardous chemical under normal conditions of use.
- 3 ☐ The SRM is a pesticide or hazardous waste labeled according to regulations issued by the Environmental protection Agency.
- 4 ☐ The SRM is a food, food additive, or drug labeled according to regulations issued by the Food and Drug Administration.
- 5 ☐ The SRM is a wine labeled according to regulations issued by the Bureau of Alcohol, Tobacco, and Firearms.
- 6 ☒ The SRM is a radioactive material labeled according to regulations issued by the Nuclear Regulatory Commission. The Shipper's Declaration form included with the shipment states chemical form, physical state, and activity of SRM.
- 7 ☐ The SRM is a tobacco or tobacco product, wood, or wood product which is exempted by paragraph (b) (5) (ii) and (iii) of section 1910.1200 of title 29 of the Code of Federal Regulations from the provisions of that section.

If we can be of assistance to you in regard to this matter, or any issue related to SRMs, please do not hesitate to write to me.

Sincerely,

Stanley D. Rasberry
Chief
Office of Standard Reference Materials

INITIAL STANDARD DILUTION RECORD

| Standard Information: | |
|---|---|
| Isotope: <u>Pu-242</u> | Vendor: <u>NIST</u> |
| Activity of Standard Received: <u> </u> uCi | Vendor I.D. #: <u>SRH 4334E</u> |
| Weight of Standard Received (g): <u>5.8</u> g | LAL I.D. #: <u>AG 5292 ^{Am 9805} _{CL 3/2/95}</u> |
| Standard Activity (pCi/g): <u>712.70</u> ^{AW} <u>1-18-95</u> <u>1582.2</u> pCi/g | NIST Traceable?: <u>yes</u> |
| Half-life in Years or Days: <u>3.733 ± 10⁵</u> yrs | Certificate #: <u>SRH 4334E</u> |
| Reference Date: <u>12-18-1989</u> | Receiver's Name: <u>K. Free</u> |
| | Date Received: <u> </u> |

| Primary Dilution | |
|--|----------------------------------|
| Balance Verification?: <u>yes</u> | |
| Diluent Used: <u>5M HNO₃</u> | |
| a: Decay Corrected Standard Activity (pCi/g): <u>712.70</u> pCi/g | |
| b: Weight of the Source Transferred (g): <u>5.5997</u> g | |
| c: Total diluted weight (g): <u>578.44</u> g | |
| d: Total Diluted Volume (mL): <u>500</u> mL | |
| e: Activity of Dilution by Weight (pCi/g) [a * b / c]: <u>6.90</u> pCi/g | |
| f: Calculated Density of Solution (g/mL) [c / d]: <u>1-18-95</u> ^{AW} <u>1.16</u> <u>1.157</u> g/mL | |
| g: Activity of Dilution by Volume (pCi/mL) [e * f]: <u>7.98</u> pCi/mL | |
| h. Dilution Logbook I.D. #: <u>94-677-27-1</u> | |
| Prepared By: <u>Dagmar Wony</u> | Preparation Date: <u>1-18-95</u> |
| Reviewed By: <u>Joe Hittner</u> | Review Date: <u>2/5/95</u> |
| Purity/Cross Check Performed By: <u>Dagmar Wony</u> | Check Date: <u>2-1-95</u> |

Signed

Date

Signed

Date

WORK GROUP REPORT (wk02)

May 22 1995, 12:20 pm

Work Group: SR-90 LAL-0196_23179 for Department: 12 Radiation Prep.

Created: 22-MAY-95 Due: 22-MAY-95 Operator:

Dave

| Sample | Account Name | Client ID | C Product | Matrix | Stat | UA | Workdate | PR | Location |
|--------|--------------|-----------|-----------|--------|------|----|----------|----|----------|
|--------|--------------|-----------|-----------|--------|------|----|----------|----|----------|

| | | | | | | | | | |
|-----------|-----------------------|-----------------|------------------|-------|-----|---|-----------|--|-----------|
| 231790UP1 | DUP | L4482-8 | S SR-90 LAL-0196 | Water | WIP | U | 22-MAY-95 | | |
| 23179LCS1 | LCS | Lab Ctrl Sample | S SR-90 LAL-0196 | Water | WIP | U | 22-MAY-95 | | |
| 23179MBB1 | MB | Method Blank | S SR-90 LAL-0196 | Water | WIP | U | 22-MAY-95 | | |
| L4482-8 | Bechtel Hanford, Inc. | BOPK16 | S SR-90 LAL-0196 | Water | WIP | U | 10-JUN-95 | | 156CART-2 |

Comments:

L4482-8 TEMP 2 "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" 1492

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION LOG FOR STRONTIUM ANALYSIS
TOTAL RADIOSTRONTIUM - LAL-91-SOP-0196

165

Date Prep Started : 6-7-95

WorkGroup : SR-90 LAL-0196 23179

Matrix : Water

Prep Due Date : 05/22/95

| CUSTOMER ID | PARENT LAL ID | NO | QC | CHILD LAL ID | ALIQVOT VOLUME (g) | SR CARRIER (ml) | YTTRIUM SEP DATE | YTTRIUM SEP TIME | PLANCHET TARE WT (grams) | PLANCHET GROSS WT (grams) | RESIDUE WEIGHT (grams) | COMMENTS |
|---------------------|---------------|-------|-----|--------------|--------------------|-----------------|------------------|-----------------------|--------------------------|---------------------------|------------------------|------------------------|
| L4482-8 | 23179DUP1 | 1 | DUP | 23179-01 | 500 me | 0.5 | 6-9-95 | 1450 | 6.88725 | 6.90096 | | new planchet gross wt. |
| Lab Ctrl Sample | 23179LCS1 | 2 | LCS | 23179-02 | 500 me | | 6-9-95 | 1450 | 6.57138 | 6.58477 | | 6.59978 |
| Method Blank | 23179MBB | 3 | MBB | 23179-03 | 500 me | | 6-9-95 | 1450 | 6.45935 | 6.47262 | | 6.58424 |
| BOFKH6 | L4482-8 | 4 | | 23179-04 | 500 me | | 6-9-95 | 1450 | 6.54837 | 6.56199 | | 6.47064 |
| | | 5 | | | | | | | | | | 6.56114 |
| | | 6 | | | | | | | | | | |
| | | 7 | | | | | | | | | | |
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| | | 23 | | | | | | | | | | |
| | | 24 | | | | | | | | | | |
| Conc&Vol of Carrier | 0.01231 g | 0.5me | | | | | Act & Vol of LCS | SR-90 26.78 pl/me 1me | | | | Prep Anlst |
| Carrier Exp Date | 1-5-96 | | | | | | LCS Ref Date | 94-07-44-1 | | | | Start Date |
| Carrier ID# | #94-658-4-1 | | | | | | LCS ID# | 4-1-94 Rg 10 | | | | Count Anlst |

Balance Number : 40020021

Pipette Number : 28875

Carrier and LCS added by :

Witnessed by : SR 10-7-95

Comments : The samples were wetashed under the heat lamp with conc. HNO₃ to rid of the excess organic materials.

Analyst : M. Armentrout 6-9-95

They were wetashed in the original conical planchet. After they were dried, they were...
Checked by : [Signature]

V95136

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION LOG FOR STRONTIUM ANALYSIS
TOTAL RADIOSTRONTIUM - LAL-91-SOP-0196

166

Date Prep Started : 06/07/95

Matrix : Water

WorkGroup : SR-90 LAL-0196 23179

Prep Due Date : 05/22/95

| CUSTOMER ID | PARENT LAL ID | NO | QC | CHILD LAL ID | ALiquot VOLUME (L) | SR CARRIER (mL) | YTTRIUM SEP DATE | YTTRIUM SEP TIME | PLANCHET TARE WT (grams) | PLANCHET GROSS WT (grams) | * * * | RESIDUE WEIGHT (grams) | COMMENTS |
|---------------------|---------------------|----|------|------------------|----------------------|-----------------|------------------|------------------|--------------------------|---------------------------|-------------|------------------------|----------|
| L4482-8 | 23179DUP1 | 1 | DUP1 | 23179-01 | 0.5000 | 0.5 | 06/09/95 | 14:50 | 6.88725 | 6.89978 | | 0.01253 | |
| Lab Ctrl Sample | 23179LCS1 | 2 | LCS1 | 23179-02 | 0.5000 | 0.5 | 06/09/95 | 14:50 | 6.57138 | 6.58424 | | 0.01286 | |
| Method Blank | 23179MBB | 3 | MBB | 23179-03 | 0.5000 | 0.5 | 06/09/95 | 14:50 | 6.45935 | 6.47064 | | 0.01129 | |
| BOFKH6 | L4482-8 | 4 | SMP | 23179-04 | 0.5000 | 0.5 | 06/09/95 | 14:50 | 6.54837 | 6.56114 | | 0.01277 | |
| | | 5 | | | | | | | | | | | |
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| | | 22 | | | | | | | | | | | |
| | | 23 | | | | | | | | | | | |
| | | 24 | | | | | | | | | | | |
| Conc&Vol of Carrier | 24.62 mg/mL; 0.5 mL | | | Act & Vol of LCS | 26.78 pCi/mL; 1.0 mL | | | Prep Anlst | GA | | | | |
| Carrier Exp Date | 05-Jan-96 | | | LCS Ref Date | 01-Apr-94 | | | Start Date | 06/07/95 | | | | |
| Carrier ID# | 94-658-4-1 | | | LCS ID# | 94-677-44-1 | | | Count Anlst | CS | | | | |

Balance Number : 40020021 ()

Pipette Number : 28875 ()

Carrier and LCS added by: GA

115364 ()

Witnessed by : LV

Comments :

Analyst : C. Schloesser for G.A. 6/20/95
(date entry)

Checked by :

7/2

V95136

AC 5751
R.5

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory-Las Vegas
Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide **Strontium-90** Half-life **28.6 years**
Nominal activity **27** **nano** curies
Nominal volume **5** ml in ampoule/bottle number **94003-1**

Measurement Activity of principal radionuclide

Activity per gram of this solution

5.40 **nano** curies of **Strontium-90**
at 0400 hours PST on **April 1, 1994**

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

5.40 **nano** curies Per gram
of the daughter nuclide **Yttrium-90**

Total mass of this solution

Approximately 5.0 grams

Method of measurement

The activity of the primary solution was measured by liquid scintillation counting.

The activity of the dilution was measured by liquid scintillation counting.

Useful Life

This radionuclide has decayed through **0.0** half lives since it was obtained by EMSL-LV

We recommend that this solution should not be used after

August 1994

This dilution was prepared for the 1994 ASTM Collaborative Study of a test method for the determination of Sr-90 in water.

Purity

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be:

| | | |
|--------------------------|--|---------------------------|
| (1) <input type="text"/> | less than equal to <input type="text"/> % | of the principal activity |
| (2) <input type="text"/> | less than equal to <input type="text"/> % | of the principal activity |
| (3) <input type="text"/> | less than equal to <input type="text"/> % | of the principal activity |

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

Random Errors

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than $\pm 0.1\%$ (The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the student t factor for the degree of freedom ($n-1$)).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ($+\delta - \delta'$). These have been estimated not to exceed

$+3.8\%$ or -3.8%

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error $[t(sm)]$ at the 99.7% confidence limits and the worst case estimate of the systematic errors ($+\delta, -\delta'$)

The overall uncertainty is therefore calculated on the basis of $+[t(sm)+\delta] - [t(sm)-\delta']$ and is $+4.0\%$ or -4.0% of the quoted radioactive concentration.

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Strontium-90 decays 100 percent by beta emission to yttrium-90. Yttrium-90 also decays 100 percent by beta emission.

**Chemical
Composition
of Solution**

Carrier content per gram of solution:
30 micrograms strontium

Other components:

0.1 M HCl

Preservative:

Remarks

Date Certificate Prepared

April 26, 1994

Approval Signature

Paul B. Fahn 170

INITIAL STANDARD DILUTION RECORD

Standard Information:

| | |
|--|---------------------------------|
| Isotope: <u>Sr-90</u> | Vendor: <u>EPA</u> |
| Activity of Standard Received: <u>2.7×10^4 uCi</u> | Vendor I.D. #: <u>94003-1</u> |
| Weight of Standard Received (g): <u>5.0 g</u> | LAL I.D. #: <u>AC5281</u> |
| Standard Activity (pCi/g): <u>5.4×10^3 pCi/g</u> | NIST Traceable? <u>yes</u> |
| Half-life in Years or Days: <u>28.6 yrs</u> | Certificate #: <u>94003-1</u> |
| Reference Date: <u>4-1-1994</u> | Receiver's Name: <u>K. Free</u> |
| | Date Received: <u>5-3-94</u> |

Primary Dilution

| |
|--|
| Balance Verification?: <u>yes</u> |
| Diluent Used: <u>0.1 M HCl</u> |
| a: Decay Corrected Standard Activity (pCi/g): <u>5.4×10^3 pCi/g</u> |
| b: Weight of the Source Transferred (g): <u>4.9670 g</u> |
| c: Total diluted weight (g): <u>49.91 g</u> |
| d: Total Diluted Volume (mL): <u>50 mL</u> |
| e: Activity of Dilution by Weight (pCi/g) [a * b / c]: <u>537.4 pCi/g</u> |
| f: Calculated Density of Solution (g/mL) [c / d]: <u>0.9982 g/mL</u> |
| g: Activity of Dilution by Volume (pCi/mL) [e * f]: <u>536.44 pCi/mL</u> |
| h. Dilution Logbook I.D. #: <u>93-474-81-1 ⁹³⁻⁴⁷⁴⁻⁸²⁻¹ <u>CP417/95</u></u> |
| Prepared By: <u>Igneas Wong</u> Preparation Date: <u>6-15-94</u> |
| Reviewed By: <u>Joe Hutchinson</u> Review Date: <u>6/30/94</u> |
| Purity/Cross Check Performed By: _____ Check Date: _____ |

Signed

Date

Signed

Date

SECONDARY/WORKING LEVEL
STANDARD DILUTION RECORD

| Dilution Source Information | |
|--|----------------------|
| Isotope: | <u>Sr-90</u> |
| Ref. <u>4-1-94</u> | |
| Parent Barcode Number | <u>AC5281</u> |
| Vendor or Certificate I.D. # of Parent Standard: | <u>EPA 94003 - 1</u> |
| Diluted Source Logbook I.D. #: | <u>93-474 -82-1</u> |
| Balance Verification?: | <u>Yes</u> |
| Diluent Used: | <u>0.1 M HCl</u> |

| Dilution | |
|--------------------------------------|---------------------------------|
| *Diluent: | <u>0.1 M HCl</u> |
| *Density of diluent (g/ml): | <u>N/A</u> |
| a: Parent Specific Activity: | <u>536.44 pCi/ml</u> |
| b: Amount of Source Transferred: | <u>5.0018 g</u> |
| c: Total amount of Dilution: | <u>100.20 g</u> |
| d: Total Volume of Dilution: | <u>N/A</u> |
| e: Activity of Dilution (a * b / c): | <u>N/A</u> |
| f: Activity of Dilution (a * b / d): | <u>26.78 pCi/ml</u> |
| Dilution Logbook I.D. #: | <u>94-677-44-1</u> |
| Prepared By: <u>Dynes Wong</u> | Preparation Date: <u>3-2-95</u> |
| Reviewed By: <u>J. H. H.</u> | Review Date: <u>3/3/95</u> |

*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Signed

Date

Signed

Date

Strontium Carrier Standardization

Strontium Carrier (10 mg/mL):

Use commercially available 10,000 μg Sr/mL ICP Standard or equivalent. Alternately, Dissolve 24.16 g of $\text{Sr}(\text{NO}_3)_2$ in water and dilute to 1 L in a volumetric flask with water.

Perform calibration check on a 0.5 mL pipet and then carefully pipet 3 - 0.5 mL portions of the strontium carrier solution into separate cleaned dried and tared planchets. Dry the planchet under a drying lamp. Cool the planchets in a desiccator and weigh.

Sr Carrier #91-208-100-1 was recalibrated to give a new calibrated value. Prepped on 1-5-95

| | Calib # 1 | Calib # 2 | Calib # 3 |
|-------------------------------|-----------|-----------|------------------------|
| Carrier plus planchet wt. | 6.60823 | 6.65050 | 6.818936 ^{AW} |
| Tare wt. of planchet | 6.59582 | 6.63805 | 6.80698 |
| Net wt. of carrier added (mg) | 0.01241 | 0.01245 | 0.012068 |

AVERAGE $\text{Sr}(\text{NO}_3)_2 \pm \text{STD DEV.} = \underline{0.01231 \text{ g}}$

Expected mg of $\text{Sr}(\text{NO}_3)_2 = \text{cert. value} (=10 \text{ mg of Sr/mL}) * 0.5 \text{ mL} * 2.41$

Within 3% of expected (12.08 mg/0.5 mL) value (yes/no) yes

Initial and Date: AW 1-10-95

Read and Understood By

Signed

Date

Signed

Date

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Strontium Carrier Standardization

Strontium Carrier (10 mg/mL):

Use commercially available 10,000 μg Sr/mL ICP Standard or equivalent. Alternately, Dissolve 24.16 g of $\text{Sr}(\text{NO}_3)_2$ in water and dilute to 1 L in a volumetric flask with water.

Perform calibration check on a 0.5 mL pipet and then carefully pipet 3 - 0.5 mL portions of the strontium carrier solution into separate cleaned dried and tared planchets. Dry the planchet under a drying lamp. Cool the planchets in a desiccator and weigh.

| | Calib # 1 | Calib # 2 | Calib # 3 |
|-------------------------------|-----------|-----------|-----------|
| Carrier plus planchet wt. | 6.58185 g | 6.49626 g | 6.56816 g |
| Tare wt. of planchet | 6.56968 g | 6.48464 g | 6.55620 g |
| Net wt. of carrier added (mg) | 0.01217 g | 0.01162 | 0.01196 g |

AVERAGE $\text{Sr}(\text{NO}_3)_2 \pm \text{STD DEV.} = 0.01192 \text{ g} \pm 0.000277$

Expected mg of $\text{Sr}(\text{NO}_3)_2 = \text{cert. value} (=10 \text{ mg of Sr/mL}) * 0.5 \text{ mL} * 2.41$

Within 3% of expected (12.08 mg/0.5 mL) value (yes/no) yes

Initial and Date: AW 3-6-94

Continued on Page

Read and Understood By QA Review:

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Signed

Date

Signed

Date

UPLOADED
DATE

WORK GROUP REPORT (WK02)
May 22 1995, 10:36 am

David

Work Group: TC-99 LAL-0169_23139 for Department: 12 Radiation Prep.

Created: 22-MAY-95 Due: 22-MAY-95 Operator:

Sample Account Name Blank ID C Product Matrix Stat UA Worksheet PA Location

| | | | | | | | | |
|------------|-----------------------|----------------------|------------------|-------|-----|---|-----------|-----------|
| 231390UP1 | DUP | L4467-6 | Page 1 | Water | WIP | U | 22-MAY-95 | |
| 231390UP2 | DUP | L4482-17 | S TC-99 LAL-0169 | Water | WIP | U | 22-MAY-95 | |
| 231390LCS1 | LCS | Lab Crt1 Sample | S TC-99 LAL-0169 | Water | WIP | U | 22-MAY-95 | |
| 231390MB1 | MB | Method Blank | S TC-99 LAL-0169 | Water | WIP | U | 22-MAY-95 | |
| L4467-6 | Bechtel Hanford, Inc. | BQFBI3 | S TC-99 LAL-0169 | Water | WIP | U | 08-JUN-95 | 156CART-2 |
| L4482-17 | Bechtel Hanford, Inc. | BQFBI6 | S TC-99 LAL-0169 | Water | WIP | U | 10-JUN-95 | 156CART-2 |
| Comments: | | | | | | | | |
| L4467-6 | | temp 2; SAF# 895-050 | | | | | | |
| L4482-17 | | TEMP 2 | | | | | | |

RADIATION RESULTS CHECK REPORT

Workgroup Number: TC-99 LAL-0169_23139

| Sample | Parameter | Value | Error | MDA |
|-----------|-----------|----------|---------|---------|
| 23139DUP1 | Tc-99 | 50.5695 | 9.28753 | 6.1273 |
| 23139DUP2 | Tc-99 | 2019.27 | 163.314 | 6.4628 |
| 23139LCS1 | Tc-99 | 843.997 | 70.9788 | 5.54817 |
| 23139MBB1 | Tc-99 | -1.23359 | 4.8096 | 6.17396 |
| L4467-6 | Tc-99 | 45.3828 | 8.78159 | 6.03677 |
| L4482-17 | Tc-99 | 1562.34 | 128.392 | 7.1227 |

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION WORKSHEET FOR Tc-99 ANALYSIS

LAL-94-SOP-0169

15 pg/L ROL
45 min

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Prep Start Date :

Matrix : Water

WorkGroup : TC-99 LAL-0169 23139

Prep Due Date : 22-May-95

| CUSTOMER ID | PARENT LAL ID | NO | QC | VIAL LAL ID | FLASK + WET SOIL (grams) | FLASK EMPTY (grams) | WET SOIL NET WT. (grams) | FLASK + DRY SOIL (grams) | DRY SOIL NET WT. (grams) | | ALLOQUOT VOLUME (g or L) | COMMENTS |
|--------------------|---------------|-------|----|------------------|--------------------------|---------------------|--------------------------|--------------------------|--------------------------|--|--------------------------|----------|
| L4467-6 | 23139DUP1 | 1 | | 23139-01 | | | | | | | 150 mL | |
| | 23139DUP1 | 1a | | 23139-02 | | | | | | | | |
| L4482-17 | 23139DUP2 | 2 | | 23139-03 | | | | | | | | |
| | 23139DUP2 | 2a | | 23139-04 | | | | | | | | |
| Lab Ctrl Sample | 23139LCS1 | 3 | | 23139-05 | | | | | | | | |
| | 23139LCS1 | 3a | | 23139-06 | | | | | | | | |
| Method Blank | 23139MBB | 4 | | 23139-07 | | | | | | | | |
| | 23139MBB | 4a | | 23139-08 | | | | | | | | |
| BOFBK3 | L4467-6 | 5 | | 23139-09 | | | | | | | 150 mL | |
| | L4467-6 | 5a | | 23139-10 | | | | | | | | |
| BOFKH6 | L4482-17 | 6 | | 23139-11 | | | | | | | | |
| | L4482-17 | 6a | | 23139-12 | | | | | | | | |
| | | 7 | | | | | | | | | | |
| | | 7a | | | | | | | | | | |
| | | 8 | | | | | | | | | | |
| | | 8a | | | | | | | | | | |
| | | 9 | | | | | | | | | | |
| | | 9a | | | | | | | | | | |
| | | 10 | | | | | | | | | | |
| | | 10a | | | | | | | | | | |
| | | 11 | | | | | | | | | | |
| | | 11a | | | | | | | | | | |
| | | 12 | | | | | | | | | | |
| | | 12a | | | | | | | | | | |
| Conc&Vol of Tracer | 9816.37 Pa/mL | 0.1mL | | Act & Vol of LCS | 111.90 Pa/mL | 1.0mL | | | | | Prep Analyst | RA |
| Tracer Ref Date | 11-1982 | | | LCS Ref Date | 10-30-91 | | | | | | Start Date | 5/26/95 |
| Tc-99 Tracer ID# | 94-677-17-1 | | | Tc-99 LCS ID# | 93-474-96-1 | | | | | | Count Analyst | LS |

Balance Number : 40020021

Pipette : #120697 0.1mL

Carrier and LCS added by: RA

Witnessed by: RA

Comments : Cocktail - Packard Insta-Gel; vial - 20 mL poly.

Analyst :

Checked by :

V95045

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION WORKSHEET FOR Tc-99 ANALYSIS

LAL-94-SOP-0169

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Prep Start Date : 5/26/95

Matrix : Water

WorkGroup : TC-99 LAL-0169 23139

Prep Due Date : 22-May-95

| CUSTOMER ID | PARENT LAL ID | NO | QC | VIAL LAL ID | FLASK + WET SOIL (grams) | FLASK EMPTY (grams) | WET SOIL NET WT. (grams) | FLASK + DRY SOIL (grams) | DRY SOIL NET WT. (grams) | ALIQOUT VOLUME (L) | COMMENTS |
|--------------------|-----------------------|-----|------|-------------|--------------------------|---------------------|--------------------------|--------------------------|--------------------------|--------------------|----------|
| L4467-6 | 23139DUP1 | 1 | DUP1 | 23139-01 | | | | | | 0.1500 | |
| | 23139DUP1 | 1a | | 23139-02 | | | | | | 0.1500 | |
| L4482-17 | 23139DUP2 | 2 | DUP2 | 23139-03 | | | | | | 0.1500 | |
| | 23139DUP2 | 2a | | 23139-04 | | | | | | 0.1500 | |
| Lab Ctrl Sample | 23139LCS1 | 3 | LCS1 | 23139-05 | | | | | | 0.1500 | |
| | 23139LCS1 | 3a | | 23139-06 | | | | | | 0.1500 | |
| Method Blank | 23139MBB | 4 | MBB1 | 23139-07 | | | | | | 0.1500 | |
| | 23139MBB | 4a | | 23139-08 | | | | | | 0.1500 | |
| BOFBK3 | L4467-6 | 5 | SMP1 | 23139-09 | | | | | | 0.1500 | |
| | L4467-6 | 5a | | 23139-10 | | | | | | 0.1500 | |
| BOFKH6 | L4482-17 | 6 | SMP2 | 23139-11 | | | | | | 0.1500 | |
| | L4482-17 | 6a | | 23139-12 | | | | | | 0.1500 | |
| | | 7 | | | | | | | | | |
| | | 7a | | | | | | | | | |
| | | 8 | | | | | | | | | |
| | | 8a | | | | | | | | | |
| | | 9 | | | | | | | | | |
| | | 9a | | | | | | | | | |
| | | 10 | | | | | | | | | |
| | | 10a | | | | | | | | | |
| | | 11 | | | | | | | | | |
| | | 11a | | | | | | | | | |
| | | 12 | | | | | | | | | |
| | | 12a | | | | | | | | | |
| Conc&Vol of Tracer | 9816.37 mg/mL; 0.1 mL | | | | Act & Vol of LCS | | 111.90 pCi/mL; 1.0 mL | | | Prep Analyst | DA |
| Tracer Ref Date | 01-Nov-82 | | | | LCS Ref Date | | 01-Sep-91 | | | Start Date | 5/26/95 |
| Tc-99 Tracer ID# | 94-677-17-1 | | | | Tc-99 LCS ID# | | 93-474-96-1 | | | Count Analyst | CS |

Balance Number : 40020021 ()

Pipette : 120697 ()

Carrier and LCS added by: DA

119510 ()

Witnessed by : RS

Comments : Cocktail - Packard Insta-Gel; vial - 20 mL poly.

Analyst : L. Schlegel for DA 5/31/95
(data entry)

Checked by : [Signature]

V95045

SEPARATE COVER.

National Bureau of Standards

Certificate

Standard Reference Material 4288

Radioactivity Standard

| | |
|---|--|
| Radionuclide | Technetium-99 |
| Source identification | 4288- 83 |
| Source description | Liquid in NBS borosilicate-glass ampoule |
| Solution composition | 59.31 μg of Tc(VII) as potassium pertechnetate per gram of approximately 0.001 molar KOH (1)* |
| Mass | 4.910 grams |
| Radioactivity concentration | $3.759 \times 10^4 \text{ Bq g}^{-1}$ |
| Reference time | November, 1982 |
| Measuring instrument | Liquid-scintillation counter (2) |
| Random uncertainty | 0.27 percent (3) |
| Systematic uncertainty | 1.35 percent (4) |
| Total uncertainty (Random plus systematic) | 1.62 percent |
| Photon-emitting impurities | None observed (5) |
| Half life | $(2.111 \pm 0.036) \times 10^5 \text{ years}$ (6) |

This Standard Reference Material was prepared in the Center for Radiation Research, Nuclear Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Washington, D.C. 20234
November, 1982

George A. Uriano, Chief
Office of Standard Reference Materials

*Notes on back
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FOOTNOTES

- (1) The KTCO_4 was prepared by M.W. Heitzmann of the U.S. Food and Drug Administration from NH_4TCO_4 obtained from Oak Ridge National Laboratory. The solution density is 0.998 g cm^{-3} at 21.8°C , and the KTCO_4 concentration is 0.00060 molar. The UV spectrum of this material exhibited only the characteristic doublets at 243 and 287 nm (A).^{*}
- (2) Two liquid-scintillation counters were calibrated using the method of J.A.B. Gibson (B,C,D). Three different radionuclides were used as the standard: ^3H , ^{14}C , and ^{60}Co . The results obtained using the three radionuclides agreed to within 0.32 percent. The ^{14}C result was used for confirmation only. The value given here is the unweighted mean of the ^3H and ^{60}Co results.
- (3) Half the 99-percent confidence interval for the average of the ^3H result and the ^{60}Co result. The standard deviation of the mean of the ^3H result is 0.15 percent based on 6 degrees of freedom, and the standard deviation of the mean of the ^{60}Co result is 0.09 percent based on 9 degrees of freedom.
- (4) The systematic uncertainty is the average of that for the ^3H result, 1.20 percent, and that for the ^{60}Co result, 1.49 percent. These values are linear sums of estimated upper limits of uncertainties due to the following:

| | <u>^3H</u> | <u>^{60}Co</u> |
|---|--------------------------------|------------------------------------|
| a) reference material for standard radionuclide | 0.63 | 0.68 |
| b) source preparation | 0.07 | 0.17 |
| c) theoretical model | 0.30 | 0.20 |
| d) gamma-ray contribution to beta-particle detector | | 0.24 |
| e) quenching | 0.10 | 0.10 |
| f) interpolation from calibration curve | <u>0.10</u> | <u>0.10</u> |
| | 1.20 | 1.49 |

- (5) The master solution from which these standards were prepared was examined with germanium gamma-ray spectrometers and no impurity was found. Limits of detection as a ratio of gamma-ray-emission rate to technetium-99 activity are

1×10^{-6} between 90 and 300 keV
 1×10^{-7} between 300 and 1900 keV.

- (6) NBS-measured half life based on the formula $T_{1/2} = N \ln(2)/A$, where N is the number of atoms, computed using an atomic mass for technetium-99 of 98.906254 ± 0.000002 grams and the gravimetrically determined mass of technetium-99, and A is the activity determined by liquid-scintillation counting. The value recommended by the Oak Ridge Nuclear Data Project is $(2.13 \pm 0.05) \times 10^5$ years. (E)

^{*} References on last page

The following individuals and organizations contributed to the characterization of this Standard Reference Material.

J.A.B. Gibson
Atomic Energy Research Establishment
Environmental and Medical Sciences Division
Harwell
United Kingdom

M.W. Heitzmann
U.S. Food and Drug Administration
Division of Drug Chemistry
Washington, D.C.

J.C. Leak
U.S. Food and Drug Administration
Division of Oncology and
Radiopharmaceutical Drug Products
Rockville, MD

For further information please contact Dr. Bert M. Coursey at (301) 921-2383.

REFERENCES

- A. Boyd, G.E., J. Chem. Ed., 36, 3 (1959).
- B. Gale, H.J. and Gibson, J.A.B., Atomic Energy Research Establishment Report AERE-R5067 (1965), Harwell, United Kingdom.
- C. Gibson, J.A.B. and Marshall, M., Int. J. Appl. Radiat. Isotopes, 23, 321 (1972).
- D. Gibson, J.A.B., Computed counting efficiencies as a function of merit figure for 14 beta-particle-emitting radionuclides (July, 1980). Unpublished data.
- E. Kocher, D.C., Radioactive Decay Data Tables DOC/TIC-11026, p. 108 (1981). Available from NTIS, Springfield, VA.

ISOTOPE WEIGHT DILUTION RECORD

Isotope: Tc-99 Vendor: NIST
 Total Received Activity: 1.85 ± 5 Bq Vendor ID: SRM 4288
 Wt. Received: 4.91 (0.001 M KOH) NIST Traceable Y/N Source 4288-83
 Activity in Units/g: 3.759 × 10⁴ Bq/g Reference Date: Nov 1982
 X 60/2.22 1.016 ± 6 pc/g Receive Date: 7-23-93 3-30-1992
 Activity converted (dpm/g): 4.988 × 10⁶ dpm/g Receiver's Name: T. Males
 Half-life (Yrs or days) t_{1/2} = 2.111 ± 5 yrs

PRIMARY DILUTION:

Balance wt. check done ☒

a: Source activity: 1.016 ± 6 pc/g dpm/g (If t_{1/2} = < 100yr decay to prep. date)
 b: Wt. of Source transferred: 4.8696 g
 Diluent used: 0.1 M NH₄OH

AA0128



Diluted

c: Total diluted weight: 146.81 g
 d: Activity of dilution (a*b/c): 3.37 ± 4 pc/g dpm/g
 e: Calculated density of solution: .9956 g/mL (4M HNO₃)
 f: Activity by volume = (d*e): 3.355 ± 4 pc/mL dpm/mL

100 mL = 99.56 g

U.S. Department of Commerce
 National Institute of Standards
 and Technology AA0128

⁹⁹Tc Radioactivity StandardAmount 3.759 × 10⁴ Bq g⁻¹Date November 1, 1982

SRM 4288

CAUTION

RADIOACTIVE



SECONDARY OR WORKING LEVEL DILUTION

Balance wt. check done ☒

Log Book ID of source being diluted: LAL 92-353-100-1
 a: Source activity: 3.355 ± 4 pc/mL dpm/g (If t_{1/2} = < 100yr decay to prep. date)
 b: Wt. of Source transferred: 2.3211 g
 Diluent used: 0.1 M NH₄OH
 c: Total diluted weight: 71.89 g
 d: Activity of dilution (a*b/c): N/A dpm/g
 e: Calculated density of solution: N/A g/mL (4M HNO₃ = 1.1294 ± .0007 g/mL)
 f: Activity by volume = (d*e): 1083 pc/mL dpm/mL
 Dilution Log Book ID: LAL 92-353-100-2

Preparer's Name: rg Swann Preparation Date: 6/16/93Reviewed By: Dyane Wany Review Date: 6/16/93

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

| Dilution Source Information | |
|--|-------------------------------|
| Isotope: | <u>Tc-99</u> |
| Parent Barcode Number | <u>AA0128</u> |
| Vendor or Certificate I.D. # of Parent Standard: | <u>SRM 4288</u> |
| Diluted Source Logbook I.D. #: | <u>92-353-100-1</u> |
| Balance Verification?: | <u>yes</u> |
| Diluent Used: | <u>0.1 M NH₄OH</u> |

| Dilution | |
|--|--|
| *Diluent: | <u>0.1 M NH₄OH</u> |
| *Density of diluent (g/ml): | <u>0.9956</u> g/ml |
| a: Parent Specific Activity: | <u>3.355 E4</u> ^{BW 11-16-94} pCi/g <u>pCi/ml</u> |
| b: Amount of Source Transferred: | <u>36.0938</u> g |
| c: Total amount of Dilution: | <u>123.36</u> g |
| d: Total Volume of Dilution: | <u>N/A</u> ml |
| e: Activity of Dilution (a * b / c): | <u>N/A</u> pCi/g |
| f: Activity of Dilution (a * b / d): | <u>9816.37</u> pCi/ml |
| Dilution Logbook I.D. #: | <u>94-677-17-1</u> |
| Prepared By: <u>Agnes Wong</u> | Preparation Date: <u>11-16-94</u> |
| Reviewed By: <u>Joe Hutchinson</u> | Review Date: <u>11/17/94</u> |
| <small>*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.</small> | |

AA0047

CERTIFICATE OF CALIBRATION BETA STANDARD SOLUTION

Radionuclide Tc-99
Half Life: $(2.13 \pm 0.05) \times 10^5$ years
Catalog No.: 7099
Source No.: 389-22-1

Customer: LOCKHEED ENGINEERING & SCIENCES Co.

P.O.No.: 06LAB1036

Reference Date: September 1 1991 12:00 PST.

Contained Radioactivity: 1.003 μCi

Description of Solution

| | | |
|----------------------|---|-----------------|
| a. Mass of solution: | 4.9929 | grams. |
| b. Chemical form: | NH ₄ TcO ₄ in 0.1M NH ₄ OH | |
| c. Carrier content: | None added | |
| d. Density: | 0.9974 | gram/ml @ 20°C. |

Radioimpurities

None detected

Radioactive Daughters

None

Radionuclide Concentration

0.201 $\mu\text{Ci/gram}$

Method of Calibration

Weighed aliquots of the solution were assayed using a liquid scintillation counter.

Uncertainty of Measurement

| | |
|--|-------------|
| a. Systematic uncertainty in instrument calibration: | $\pm 2.1\%$ |
| b. Random uncertainty in assay: | $\pm 1.0\%$ |
| c. Random uncertainty in weighing(s): | $\pm 0.0\%$ |
| d. Total uncertainty at the 99% confidence level: | $\pm 3.1\%$ |

NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

Notes

1. Nuclear data were taken from "Table of Isotopes", Seventh Edition, edited by Virginia S. Shirley.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials. (As in NRC Regulatory Guide 4.15)



ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone Street.,
Burbank, California 91504
(818) 843 - 7000


QUALITY CONTROL

AA004 /
ISOTOPE WEIGHT DILUTION RECORD

AA0047

Isotope: Tc - 99

Vendor: IPL

Total Received Activity: ~1 μ Ci

Vendor ID: 389-22-1

Wt. Received: ~5 g

NIST Traceable (Y) N Cert. # implicitly

Activity in Units/g: ~~0.20~~ 0.20 μ Ci/g

Reference Date: 9-1-91

Activity converted (dpm/g): _____ dpm/g

Receive Date: ~~N/A~~ 10-30-1991

Half-life (Yrs or days) $t_{1/2}$ = 2.13×10^5 years

Receiver's Name: ~~N/A~~ Jimmy Mura

PRIMARY DILUTION:

Balance wt. check done (\checkmark)

a: Source activity: 2.01×10^5 pCi/g dpm/g ^{AW} (if $t_{1/2}$ = < 100yr decay to prep. date)

b: Wt. of Source transferred: 4.9320 g

Diluent used: 0.1 M NH_4OH

c: Total diluted ^{volume} weight: 100 ml g ^{AW}

d: Activity of dilution (a*b/c): N/A dpm/g

e: Calculated density of solution: N/A g/mL (4M HNO_3 = $1.1294 \pm .0007$ g/mL)

f: Activity by volume = (d*e): 9910 pCi/mL dpm/mL ^{AW}

Dilution Log Book ID: 91-225-41-1

Preparation Date: 1-23-92 Preparer's Name: Joe Hutchinson

SECONDARY OR WORKING LEVEL DILUTION

Balance wt. check done ()

Log Book ID of source being diluted: 91-225-42-1

a: Source activity: 9910 pCi/mL dpm/g * (if $t_{1/2}$ = < 100yr decay to prep. date)

b: Wt. of Source transferred: 1.0051 g

Diluent used: 0.1 M NH_4OH

c: Total diluted weight: 50.621 g

d: Activity of dilution (a*b/c): N/A dpm/g

e: Calculated density of solution: 997 g/mL g/mL (4M HNO_3 = $1.1294 \pm .0007$ g/mL)

f: Activity by volume = ^{a*b/c} (d*e) 196.8 pCi/mL dpm/mL

Dilution Log Book ID: 91-225-42-1

Preparer's Name: Joe Hutchinson Preparation Date: 1-27-92

Reviewed By: ra3 Review Date: 6/8/93

SECONDARY / WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information

Isotope:

Tc-99

From NIST traceable standard?:

Implicitly

Vendor or Certificate I.D. # of parent standard:

AA0047

Diluted source logbook I.D. #:

91-225-41-1

Balance verification?:

yes

Diluent used:

0.1M NH₄OH

Dilution

Diluent:

0.1M NH₄OH

Density of diluent (g/ml):

N/A

a. Parent standard activity:

99.5 pCi/ml

b. Amount of standard transferred:

2.8759 g

c. Total amount of dilution:

254.69 g

d. Activity of dilution [a * b / c]:

111.90 pCi/ml as of 9-1

Dilution logbook I.D. #:

93-474-96-1

Prepared by:

Agnes Wong

Preparation date:

8-17-94

Reviewed by:

Joe Hutchinson

Review date:

8/25/94

If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

LAL-91-SOP-0174

SECONDARY / WORKING LEVEL STANDARD DILUTION RECORD

| Dilution Source Information | |
|--|--------------------------|
| Isotope: | Tc-99 |
| From NIST traceable standard?: | Implicitly |
| Vendor or Certificate I.D. # of parent standard: | AA0047 |
| Diluted source logbook I.D. #: | 91-225-41-1 |
| Balance verification?: | yes |
| Diluent used: | 0.1 M NH ₄ OH |

| Dilution | |
|---|----------------------------|
| *Diluent: | 0.1 M NH ₄ OH |
| *Density of diluent (g/ml): | N/A |
| a. Parent standard activity: | 9910 pCi/ml |
| b. Amount of standard transferred: | 1.9605 g |
| c. Total amount of dilution: | 166.25 g |
| d. Activity of dilution [a * b / c]: | 116.86 pCi/ml as of 9-1-94 |
| Dilution logbook I.D. #: | 93-474-97-1 |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Prepared by: <u>Dyane Wong</u></p> <p>Reviewed by: <u>Joe Hatcher</u></p> </div> <div style="width: 45%;"> <p>Preparation date: <u>8-17-94</u></p> <p>Review date: <u>8/25/94</u></p> </div> </div> | |
| <p>*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.</p> | |

LAL-91-SOP-0174

Lockheed Analytical Laboratory

Sample Preparation Worksheet for Total Uranium (KPA) Analysis

1961

Date Prep Started : 6/9/95

Workgroup Number : U TOTAL KPA LAL-0168 23131

Matrix : Water

Prep Due Date : 22-May-95 8H 6/3/95

| CLIENT ID | LAL ID | QC | ALIQOT (ml, g, sample) | DILUTION | COMMENTS | Client | Collection Date |
|-----------------|-----------|----|------------------------|----------|-----------------------------|-------------------------|-----------------|
| L4482-8 | 23131DUP1 | 1 | Dupl 10 ml | 1 | RPD = 8.24 7.29. 6/11/95 | DUP | 05/22/95 |
| Lab Ctrl Sample | 23131LCS1 | 2 | LCS1 | 1 | Rec = 102% | LCS | 05/22/95 |
| Method Blank | 23131MBB1 | 3 | MBB1 | 1 | | MB | 05/22/95 |
| L4482-8 | 23131MS1 | 4 | MS1 | (5) | Rec = 68% 6/11/95 @ 5x 113% | MS | 05/22/95 |
| BOFKH6 | L4482-8 | 5 | SAMPLE, MS1 | 1 | | Bechtel Hanford, Inc. * | 05/09/95 |
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COMMENTS:

| | | | | | | | |
|---------------|-------------|----------------|-------------------------|---------------|--------------------------|--------------|--------------------------|
| CCV4 100 µg/L | 99-677-53-1 | Amount of CCV4 | 5 µg/L (Hatched 6/9/95) | Amount of LCS | 1 ml of 100 µg/L → 10 ml | Amount of MS | 1 ml of 100 µg/L → 10 ml |
| CCV Activity | 5 µg/L | LCS Activity | 10 µg/L | MS Activity | 10 µg/L | | |
| CCV ID# | 9101373833A | LCS ID# | 9101873333B | MS ID# | 95012A | | |

Balance Number : 39120015 6/9/95

Pipette Number : 518548N 6/9/95

Tracer, LCS, & MS added by : Dms

Sample Prep Analyst : P.M. Bay 6/9/95

LAL-95-LOG-0711

Checked by : Joe Hitehian

Witnessed by : Dms

Rm 159

WORK GROUP REPORT (WK02)

May 22, 1995, 04:42 pm

Work Group: U TOTAL KPA LAL-0168_23131 for Department: 12 Radiation Prep.

Created: 22-MAY-95 Due: 22-MAY-95 Operator:

Todd

| Sample | Account Name | ClientID | C Product | Matrix | Stat | UA | Workdate | PR Location |
|-----------|---|-----------------|------------------------|--------|------|----|-----------|-------------|
| Page 1 | | | | | | | | |
| 23131DUP1 | DUP | L4482-8 | S U TOTAL KPA LAL-0168 | Water | WIP | U | 22-MAY-95 | |
| 23131LCS1 | LCS | Lab Ctrl Sample | S U TOTAL KPA LAL-0168 | Water | WIP | U | 22-MAY-95 | |
| 23131MBB1 | MB | Method Blank | S U TOTAL KPA LAL-0168 | Water | WIP | U | 22-MAY-95 | |
| 23131MS1 | MS | L4482-8 | S U TOTAL KPA LAL-0168 | Water | WIP | U | 22-MAY-95 | |
| L4482-8 | Bechtel Hanford, Inc. | B0FKH6 | S U TOTAL KPA LAL-0168 | Water | WIP | U | 10-JUN-95 | 156CART-2 |
| Comments: | | | | | | | | |
| L4482-8 | TEMP 2 "GAMMA SPEC TO INCLUDE Cs137, Co-60, Ru-106" | | | | | | | |

RADIATION RESULTS CHECK REPORT

Workgroup Number: U TOTAL KPA LAL-0168_23131

| Sample | Parameter | Value | Error | MDA |
|-----------|-----------|---------|----------|----------|
| 23131DUP1 | Uranium | 3.08239 | 0.158985 | 0.201804 |
| 23131LCS1 | Uranium | 10.2079 | 0.527096 | 0.201804 |
| 23131MBB1 | Uranium | 0 | 0 | 0 |
| 23131MS1 | Uranium | 14.636 | 0.755089 | 1.00902 |
| L4482-8 | Uranium | 3.31059 | 0.170834 | 0.201804 |

D.M. Boyer 6-12-95

UPLOADED
05/25

WORK GROUP REPORT (wk02)

May 22 1995, 12:24 pm

Work Group: TRITIUM(H3) LAL-0066_23181 for Department: 12 Radiation Prep.

Created: 22-MAY-95 Due: 22-MAY-95 Operator:

| Sample | Account Name | ClientID | C Product | Matrix | Stat | UA | Workdata | PR Location |
|-----------|-----------------------|-----------------|------------------------|--------|------|----|-----------|-------------|
| Page 1 | | | | | | | | |
| 23181DUP1 | DUP | L4882-16 | S TRITIUM(H3) LAL-0066 | Water | WIP | U | 22-MAY-95 | |
| 23181LCS1 | LCS | Lab Ctrl Sample | S TRITIUM(H3) LAL-0066 | Water | WIP | U | 22-MAY-95 | |
| 23181MBB1 | MB | Method Blank | S TRITIUM(H3) LAL-0066 | Water | WIP | U | 22-MAY-95 | |
| 23181MS1 | MS | L4482-16 | S TRITIUM(H3) LAL-0066 | Water | WIP | U | 22-MAY-95 | |
| L4482-16 | Bechtel Hanford, Inc. | B0FKH6 | S TRITIUM(H3) LAL-0066 | Water | WIP | U | 10-JUN-95 | 156-020 |
| Comments: | | | | | | | | |
| L4482-16 | TEMP 2 | | | | | | | |

RADIATION RESULTS CHECK REPORT

Workgroup Number: TRITIUM(H3) LAL-0066_23181

| Sample | Parameter | Value | Error | MDA |
|-----------|-----------|----------|---------|---------|
| 23181DUP1 | H-3 | 264.866 | 206.758 | 256.357 |
| 23181LCS1 | H-3 | 2666.84 | 394.29 | 256.143 |
| 23181MBB1 | H-3 | -107.663 | 160.892 | 251.668 |
| 23181MS1 | H-3 | 3945.94 | 469.989 | 255.39 |
| L4482-16 | H-3 | 358.866 | 217.242 | 257.829 |

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION WORKSHEET FOR H-3 ANALYSIS

SOP-0066

215

Prep Start Date : 5/25/95

WorkGroup : TRITIUM(H3) LAL-0066 23181

Matrix : Water

Prep Due Date : 22-May-95

| CUSTOMER ID | PARENT LAL ID | NO | QC | VIAL LAL ID | FLASK + WET SOIL (grams) | FLASK EMPTY (grams) | WET SOIL NET WT. (grams) | FLASK + DRY SOIL (grams) | DRY SOIL NET WT. (grams) | DISTILLED VOLUME (L) | ALICUOT VOLUME (L) | COMMENTS | | |
|------------------|-------------------|----|----|-------------|--------------------------|---------------------|--------------------------|--------------------------|--------------------------|----------------------|--------------------|----------|---------------|------------------|
| L4882-16 | 23181DUP1 | 1 | | 23181-01 | | | | | | | 0.010 | | | |
| Lab Ctrl Sample | 23181LCS1 | 2 | | 23181-02 | | | | | | | | | | |
| Method Blank | 23181MBB | 3 | | 23181-03 | | | | | | | | | | |
| L4482-16 | 23181MS1 | 4 | | 23181-04 | | | | | | 0.05049 | | | | |
| BOFKH6 | L4482-16 | 5 | | 23181-05 | | | | | | | ✓ | | | |
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| | | 24 | | | | | | | | | | | | |
| Conc & Vol of MS | 469 dpm/ml - 1 ml | | | | Conc & Vol of LCS | | | | 3448 pCi/L | | | | Prep Analyst | C.A. Schloesslin |
| MS Ref Date | 6-8-93 | | | | LCS Ref Date | | | | 6-3-92 | | | | Start Date | 5/25/95 |
| H-3 MS ID# | LX-93-474-18-1 | | | | H-3 LCS ID# | | | | LAL-95-0721-E | | | | Count Analyst | |

Balance Number : 40020026 (1)

Pipette : 82200 (1)
4055 (1)

MS and LCS added by: C.A. Schloesslin
Witnessed by: DA 5/25/95

Comments : Cocktail - Packard Ultima Gold XR; vial - 20 mL poly.

Analyst : Cheryl A. Schloesslin 5/25/95

Checked by : [Signature]

V95118

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION WORKSHEET FOR H-3 ANALYSIS

SOP-0066

216

Prep Start Date : 5/22/95

Matrix : Water

WorkGroup : TRITIUM(H3) LAL-0066 23181

Prep Due Date : 22-May-95

| CUSTOMER ID | PARENT LAL ID | NO | QC | VIAL LAL ID | FLASK + WET SOIL (grams) | FLASK EMPTY (grams) | WET SOIL NET WT. (grams) | FLASK + DRY SOIL (grams) | DRY SOIL NET WT. (grams) | DISTILLED VOLUME (L) | ALiquot VOLUME (L) | COMMENTS |
|-----------------|-----------------------|----|------|-------------|--------------------------|---------------------|--------------------------|--------------------------|--------------------------|----------------------|--------------------|---------------------------|
| L4882-16 | 23181DUP1 | 1 | DUP1 | 23181-01 | | | | | | | 0.01 | |
| Lab Ctrl Sample | 23181LCS1 | 2 | LCS1 | 23181-02 | | | | | | | 0.01 | |
| Method Blank | 23181MBB | 3 | MBB | 23181-03 | | | | | | | 0.01 | |
| L4482-16 | 23181MS1 | 4 | MS1 | 23181-04 | | | | | | | 0.01 | 1 mL MS added to |
| BOFKH6 | L4482-16 | 5 | SMP1 | 23181-05 | | | | | | | 0.01 | 50 mL MSS then distilled. |
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| Conc&Vol of MS | 211.26 pCi/mL; 1.0 mL | | | | Conc & Vol of LCS | | 3.45 pCi/mL; 10.0 mL | | | Prep Analyst | | CAS |
| MS Ref Date | 18-Jun-93 | | | | LCS Ref Date | | 03-Jun-92 | | | Start Date | | 5/22/95 |
| H-3 MS ID# | 93-474-18-1 | | | | H-3 LCS ID# | | 95-721-5-1 | | | Count Analyst | | CS |

Balance Number : 40020026 ()

Pipette : 82200 ()

MS and LCS added by: CAS

4055 ()

Witnessed by : DA

Comments : Cocktail - Packard Ultima Gold XR; vial - 20 mL poly.

Analyst : L. Schlesselman for CAS 5/26/95
(data entry)

Checked by : [Signature]

V95118



CERTIFICATE OF ANALYSIS

Catalog Number: PLU2-2X Lot No. 4-27U
Element and Matrix: U/HNO₃/H₂O
Starting Material: Uranium Oxide U₃O₈
Starting Material Lot Number: 12921A

DC ARC: Trace Metallic Impurities in starting material via DC ARC [40 elements checked; only values detected are listed].

| Element | PPM |
|---------|------|
| Pb | 3-5 |
| Cu | 5-10 |
| Ag | 3-7 |

Traceability Documentation For Solution Standard:

1. Classical Wet Assay: 1,005 ppm.

Gravimetry: Evaporate to dryness, ignite and weigh as U₃O₈.

2. Instrumentation Analysis By Inductively Coupled Plasma Spectrometer[ICP]: 998 ppm via NIST SRM 3164.

3. Balances are calibrated with NIST weight sets N.J. #92589 and #92550, according to NIST circular 547 3.4.3.

SPEX plasma solution standards are guaranteed stable and accurate to $\pm 0.5\%$ of labeled concentration for one year from date of shipment. This value is the sum of cumulative errors associated with analytical determinations, pipetting and diluting to final volume. For these solutions we use high purity acids, 18 megohm double deionized water and triple rinsed bottles. All glassware used is class A.

Signed by: N. Kochendakota Chemical Production Manager, Date: AUG 94



Printed on Recycled Paper

SECONDARY/WORKING LEVEL
STANDARD DILUTION RECORD

| Dilution Source Information | |
|--|-------------------------------|
| Isotope: | <u>CX-Natural</u> |
| Parent Barcode Number | <u>NIA</u> |
| Vendor or Certificate I.D. # of Parent Standard: | <u>SPEX PL42-2X Lot 4-27a</u> |
| Diluted Source Logbook I.D. #: | <u>94-677-57-1</u> |
| Balance Verification?: | <u>NIA</u> |
| Diluent Used: | <u>1 N HNO₃</u> |

| Dilution | |
|--------------------------------------|--|
| *Diluent: | <u>1 N HNO₃ Trace metal Grade</u> |
| *Density of diluent (g/ml): | <u>NIA</u> g/ml |
| a: Parent Specific Activity: | <u>10,000 μCi/g 5/17/95</u> |
| b: Amount of Source Transferred: | <u>1 mL g pipet # 71008</u> |
| c: Total amount of Dilution: | <u>NIA</u> g |
| d: Total Volume of Dilution: | <u>100</u> mL |
| e: Activity of Dilution (a * b / c): | <u>100 μCi/g 5/17/95</u> |
| f: Activity of Dilution (a * b / d): | <u>100 μCi/mL 5/17/95</u> |
| Dilution Logbook I.D. #: | <u>94-677-58-1</u> |
| Prepared By: <u>[Signature]</u> | Preparation Date: <u>5/17/95</u> |
| Reviewed By: <u>[Signature]</u> | Review Date: <u>5-6-18-95</u> |

*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Agnes Wong

Dilution Source Information

Isotope: Uranium - Natural

Parent Barcode Number: N/A

Vendor or Certificate I.D. # of Parent Standard: PL42-2X Lot 4-27G SPEX

Diluted Source Logbook I.D. #: N/A

Balance Verification?: N/A

Diluent Used: 1M HNO₃ Trace Metal Grade

Dilution

*Diluent: 1M HNO₃ Trace Metal Grade

*Density of diluent (g/ml): N/A g/ml

a: Parent Specific Activity: ⁵¹¹⁷¹⁵
pCi/g 1000 μ S/mL

b: Amount of Source Transferred: 1mL \pm pipet #71008

c: Total amount of Dilution: 100mL \pm 511715

d: Total Volume of Dilution: 100 ml Volumetric Flask

e: Activity of Dilution (a * b / c): pCi/g

f: Activity of Dilution (a * b / d): 10,000 μ S/L
~~pCi/mL~~ ⁵¹¹⁷¹⁵

Dilution Logbook I.D. #: 94-0677-57

Prepared By: *ju*

Reviewed By: *AW*

Preparation Date: 5/17/95

Review Date: 6-18-95

*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Read and Understood by _____



Certificate of Analysis

Standard Reference Material 3164

Spectrometric Standard Solution

Uranium

Batch Code 390709

This Standard Reference Material (SRM) is intended for use in atomic absorption spectrometry, optical emission (plasma) spectrometry, spectrophotometry, or any other analytical technique that requires aqueous standard solutions for calibrating instruments. SRM 3164 is a single element solution prepared gravimetrically to contain 10 mg/mL of uranium with a nitric acid concentration (V/V) of 10 percent. The certified value is based on a gravimetric procedure, i.e., weight per volume composition of the high-purity uranium oxide dissolved in NIST high-purity reagents. The uncertainty listed is based on gravimetric and volumetric uncertainties of the preparation and the effect of solvent transpiration through the container walls for one year after the bottle is removed from the plastic sleeve.

| Metal | Concentration (mg/mL) | Source Purity, % | Acid Conc. (V/V) Approximate |
|-------|--------------------------|--|---------------------------------|
| U | 10.00 \pm 0.03 | NBL-CRM 129 (99.968%) (formerly SRM 950b) | HNO ₃ , 10% |

Procedures for Use

Stability: This certification is valid for one year from the date of shipment from NIST provided the solutions are kept tightly capped and stored under normal laboratory conditions. NIST will monitor the stability of representative solutions from this SRM lot and if changes occur that invalidate this certification, NIST will notify purchasers.

Preparation of Working Standard Solutions: All solutions should be brought to 22 ± 1 °C and all glass or plastic surfaces coming into contact with the standard must have been previously cleaned. A working standard solution can be prepared from the SRM solution by serial dilution. Dilutions should be made with certified volumetric class A flasks and 5 or 10 mL class A pipets. All volumetric transfers of solutions should be performed using a proven analytical technique. Each dilution should be acidified with an appropriate high-purity acid and diluted to calibrated volume using high-purity water. The stability of the working standard solution will depend on the final acid concentration; therefore, care should be exercised to ensure that the final acid concentration of the dilution closely approximates that of the SRM. To achieve the highest accuracy, the analyst should prepare daily working solutions from 100 μ g/mL dilutions of the original SRM solution.

SRM 3164 was prepared by T.A. Butler of the NIST Inorganic Analytical Research Division. Inductively coupled plasma emission spectrometric analyses were made by T.A. Butler and L.J. Wood.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.S. Kane.

Gaithersburg, MD 20899
October 5, 1993

Thomas E. Gills, Acting Chief
Standard Reference Materials Program

U.S. Environmental Protection Agency
 Environmental Monitoring Systems Laboratory-Las Vegas
 Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide **Tritium (H-3)** Half-life **12.43 years**
 Nominal activity **110** **nano** curies
 Nominal volume **5** ml in ampoule/bottle number **2606-1**

Measurement Activity of principal radionuclide

Activity per gram of this solution

21.9 **nano** curies of **Tritium**
 at 0400 hours PST on **June 3, 1992**

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

curies Per gram
 of the daughter nuclide

Total mass of this solution

APPROX. 5.0 grams

Method of measurement

The activity of the primary solution and this dilution were measured by liquid scintillation counting.

Counting efficiencies for both standardizations were determined by counting solutions directly traceable to the National Institute of Standards & Technology (NIST).

Useful Life

This radionuclide has decayed through **0.0** half lives since it was obtained by EMSL-LV
 We recommend that this solution should not be used after **December 1999**

Purity

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be:

| | | | | |
|----------|--------------------|--|---|---------------------------|
| (1) none | less than equal to | | % | of the principal activity |
| (2) | less than equal to | | % | of the principal activity |
| (3) | less than equal to | | % | of the principal activity |

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

Random Errors

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than $\pm 0.4\%$ (The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the student t factor for the degree of freedom ($n-1$)).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ($+\delta - \delta'$). These have been estimated not to exceed

$+2.9\%$ or -2.9%

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error $[t(sm)]$ at the 99.7% confidence limits and the worst case estimate of the systematic errors ($+\delta - \delta'$)

The overall uncertainty is therefore calculated on the basis of $+ [t(sm) + \delta] - [t(sm) + \delta']$ and is $+4.3\%$, -4.3% of the quoted radioactive concentration.

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Tritium decays 100 percent by beta emission. The maximum energy is 18.6 Kev, the average is 5.68 Kev.

Chemical Composition of Solution

Carrier content per gram of solution:

100 percent H_2O

Other components:

Barium less than 0.004 per cent
Lead less than 3×10^{-5} per cent

Preservative:

Remarks

Date Certificate Prepared

June 17, 1992

Approval Signature

George Tulbeck



U.S. DEPARTMENT OF COMMERCE
National Institute of Standards & Technology
Gaithersburg, MD 20899

REPORT OF TRACEABILITY

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada

| | |
|-----------------------|---|
| Radionuclide | Hydrogen-3 |
| Source identification | 2606-1, prepared by EMSL |
| Source description | Liquid in 5-mL flame-sealed glass ampoule |
| Source mass | Approximately 5.0 grams |
| Source composition | Hydrogen-3 in water |
| Reference time | 0700 EST June 3, 1992 |

| | <u>NIST DATA</u> | <u>EMSL DATA</u> |
|-----------------------------|--|----------------------------------|
| Radioactivity concentration | 810.5 Bq g ⁻¹ | 810.3 Bq g ⁻¹ |
| Expanded uncertainty | 0.64 percent ^{(1,2)*} | 4.3 percent ⁽³⁾ |
| Photon-emitting impurities | None observed ⁽⁴⁾ | None observed |
| Measuring instrument | 4 π β liquid-scintillation counters calibrated with SRM 4926D | Liquid-scintillation counting |
| Half life | 12.43 \pm 0.05 years ⁽⁵⁾ | |
| Difference from NIST | | -0.05 percent ⁽⁶⁾ |

For the Director,

J.M. Robin Hutchinson, Acting Group Leader
Radioactivity Group
Physics Laboratory

Gaithersburg, MD 20899
January 1994

*Notes on next page

NOTES

- (1) The uncertainty analysis methodology and nomenclature used for the reported uncertainties are based on uniform NIST guidelines and are compatible with those adopted by the principal international metrology standardization bodies [cf., B.N. Taylor and C.E. Kuyatt, *NIST Technical Note 1129* (1993)].
- (2) The combined standard uncertainty, $u_c = 0.32$ percent, is the quadratic combination of the standard deviation (or standard deviation of the mean where appropriate), or approximations thereof, for the following component uncertainties:
- | | |
|--|--------------|
| a) 11 liquid-scintillation measurements on each of 4 vials | 0.11 percent |
| b) gravimetric | 0.05 percent |
| c) calibration of SRM 4926D | 0.29 percent |
| d) background | 0.00 percent |
| e) half life | 0.03 percent |
- The expanded uncertainty, $U = 0.64$ percent, is obtained by multiplying u_c by a coverage factor of $k = 2$ and is assumed to provide an uncertainty interval of at least 95% confidence.
- (3) Overall uncertainty reported by EMSL.
- (4) The limit of detection for photon-emitting impurities is:
- $0.08 \text{ } \gamma \text{ s}^{-1} \text{ g}^{-1}$ for energies between 90 and 2700 keV.
- (5) Unterwiesing, M.P., Coursey, B.M., Schima, F.J., and Mann, W.B., Int. J. Appl. Radiat. Isot., **31**, 611 (1980).
- (6) This result demonstrates the traceability of EMSL to NIST, for this measurement, to within five percent as specified in the appendix, Traceability Studies, of the EPA-NIST interagency agreement of April 1976, as amended.

For further information call Larry Lucas at 301-975-5546 or Jeffrey Cessna at 301-975-5539.

PROJECT

H-3

Notebook No. 0721

Continued From Page

NA

INITIAL STANDARD DILUTION RECORD

| Standard Information: | |
|----------------------------------|---------------------|
| Isotope: | H-3 |
| Activity of Standard Received: | .11 uCi |
| Weight of Standard Received (g): | 5 g |
| Standard Activity (pCi/g): | 21.9 nCi/g pCi/g |
| Half-life in Years or Days: | 12.43 yrs |
| Reference Date: | 0400, 6/3/92 |
| Vendor: | EPA |
| Vendor I.D. # | 947195 |
| LAL I.D. #: | AC 5299 |
| NIST Traceable? | Yes |
| Certificate #: | 2606-1 |
| Receiver's Name: | Kevin Free |
| Date Received: | 1/25/95 |

| Primary Dilution | |
|--|--|
| Balance Verification?: | Yes |
| Diluent Used: | EPA Distilled ASTM Type II Water (Dead Water) |
| a: Decay Corrected Standard Activity (pCi/g): | 21.9 nCi/g 4.939 pCi/g on 6/3/92 |
| b: Weight of the Source Transferred (g): | 4.939 g |
| c: Total diluted weight (g): | 49.377 g |
| d: Total Diluted Volume (mL): | 50 49.5 mL |
| e: Activity of Dilution by Weight (pCi/g) [a * b / c]: | 2190 pCi/g |
| f: Calculated Density of Solution (g/mL) [c / d]: | 0.99777 g/mL |
| g: Activity of Dilution by Volume (pCi/mL) [e * f]: | 2190 pCi/mL on 6/3/92 |
| h. Dilution Logbook I.D. #: | C. P. P. 95-0721-1 |
| Prepared By: | J. C. P. / J. Morales |
| Preparation Date: | 2/7/95 |
| Reviewed By: | Joe Hutchinson |
| Review Date: | 2/7/95 |
| Purity/Cross Check Performed By: | |
| Check Date: | |

Signed

Date

CP 5/8/95

Signed

Date
224

H3- LCS

Notebook No. 721

Continued From Page 12/A

PROJECT

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information

Isotope: H-3 LCS

Parent Barcode Number: AC5299

Vendor or Certificate I.D. # of Parent Standard: 2608-1

Diluted Source Logbook I.D. #: LAL-95-0721-1

Balance Verification?: Yes

Diluent Used: Deep well water - low H3

Dilution

*Diluent: Deep well water - low H3

*Density of diluent (g/ml): 0.99 g/ml

a: Parent Specific Activity: 2190 pCi/g

b: Amount of Source Transferred: 3^{PTIA} 5.0 g

c: Total amount of Dilution: 3208 g

d: Total Volume of Dilution: 3176 ml

e: Activity of Dilution [a * b / c]: 3.413 pCi/g

f: Activity of Dilution [a * b / d]: 3.448 pCi/ml = 3448 pCi/L on 6/3/92

Dilution Logbook I.D. #: LAL-95-0721-5

Prepared By: G. A. M. andPreparation Date: 4/14/95Reviewed By: Joe HutchinsonReview Date: 4/14/95

*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.

Read and Understood By

CP

225
5/8/95

Signed

Date

Signed

Date

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory-Las Vegas
Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide Tritium (H-3) Half-life 12.43 years
Nominal activity 55.2 nano curies
Nominal volume 5 ml in ampoule/bottle number 2548-1

Measurement Activity of principal radionuclide

Activity per gram of this solution

11.03 nano curies of Tritium
at 0400 hours PST on August 10, 1989

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

 curies Per gram
of the daughter nuclide

Total mass of this solution

APPROX. 5.0 grams

Method of measurement

The activity of the primary solution and this dilution were measured by liquid scintillation counting.

Efficiencies were measured by counting solutions prepared from the National Institute of Standards & Technology.

Useful Life

This radionuclide has decayed through half lives since it was obtained by EMSL-LV

We recommend that this solution should not be used after

Purity

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be

| | | | | |
|----------|-----------|--|---|---------------------------|
| (1) none | less than | | % | of the principal activity |
| (2) | equal to | | % | of the principal activity |
| (3) | equal to | | % | of the principal activity |

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

Random Errors

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than \pm 0.2 %

(The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the student t factor for the degree of freedom ($n-1$)).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error ($+\delta - \delta'$). These have been estimated not to exceed

+ 3.5 % or - 3.5 %

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error [$t(sm)$] at the 99.7% confidence limits and the worst case estimate of the systematic errors ($+\delta, -\delta'$)

The overall uncertainty is therefore calculated on the basis of $+ [t(sm) + \delta], - [t(sm) + \delta]$ and is + 4.1 % , - 4.1 % of the quoted radioactive concentration.

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Tritium decays 100 percent by beta emission. The maximum energy is 18.6 Kev, the average is 5.68 Kev.

Chemical Composition of Solution

Carrier content per gram of solution:

100 percent H₂O

Other components:

Barium less than 0.002 per
Lead less than 2×10^{-5} per

Preservative:

Remarks

Date Certificate Prepared August 29, 1989

Approval Signature

227
Paul B. Wahn

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
GAITHERSBURG, MD 20899

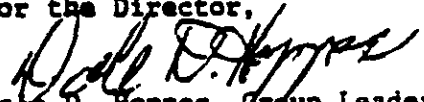
REPORT OF TRACEABILITY

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory
Las Vegas, Nevada

| | |
|-----------------------|---|
| Radionuclide | Hydrogen-3 |
| Source identification | 2548-1, prepared by EMSL |
| Source description | Liquid in 5-ml flame-sealed glass ampoule |
| Source mass | Approximately 5.0 grams |
| Source composition | Hydrogen-3 as HTO in water |
| Reference time | 0700 EST, 10 August 1989 |

| | <u>NIST DATA</u> | <u>EMSL DATA</u> |
|---|--|-------------------------------------|
| Radioactivity concentration | 419.4 Bq g ⁻¹ | 408.1 Bq g ⁻¹ |
| Overall uncertainty | 1.08 percent ^{(1)*} | 4.10 percent ⁽²⁾ |
| Beta-particle-emitting impurities (Activities at reference time) | None detected ⁽³⁾ | None reported |
| Measuring instrument | 4πβ liquid-scintillation counter calibrated using NIST SRM 4927A | 4πβ liquid-scintillation counter |
| Half life | 12.35 ± 0.01 years ⁽⁴⁾ | |
| Difference from NIST | | -2.68 percent ⁽⁵⁾ |

Gaithersburg, MD 20899
10 May 1990

For the Director,

Dale D. Hoppes, Group Leader
Radioactivity Group
Center for Radiation Research

*Notes on next page

As guidance for the proper use of this Report, it should be emphasized that the National Bureau of Standards is concerned only with fostering good measurements capability and consistency with the national measurements system. The assurance of the proper application of that capability to the ultimate consumer products is the responsibility of each manufacturer of these products and of the Federal regulatory agencies.

A continuing traceability program in radioactivity demonstrates, to the degree established by the periodic assays of calibrated radioactivity samples, a continuing competence to maintain the instrument systems and standards necessary for accurate measurement. Such a program cannot, however, endorse each and every measurement nor the final product, any more than a spot check can vouch for every unchecked item. Care should be taken, therefore, not to imply such endorsement. The proper use of this Report is governed by section 200.114 of Title 15 of the Code of Federal Regulations. These regulations may be met if this Report, if quoted, is quoted in its entirety. Excerpts out of context may be misleading.

NOTES

- (1) Individual uncertainties have the significance of one standard deviation of the mean, or an approximation thereof. The combined uncertainty is the individual uncertainties shown below added in quadrature. The overall uncertainty is taken to be three times the combined uncertainty.

| <u>Source of uncertainty</u> | <u>Uncertainty (%)</u> |
|--|------------------------|
| a) beta-particle-emission-rate measurements | 0.05 |
| b) gravimetric measurements | 0.20 |
| c) deadtime | 0.01 |
| d) background | 0.02 |
| e) detection efficiency | 0.10 |
| f) count-rate-vs-energy extrapolation to zero energy | 0.10 |
| g) half life | 0.05 |
| h) beta-particle-emitting impurities | 0.10 |
| Combined uncertainty | <u>0.36</u> |
| | * 3 |
| Overall uncertainty | <u>1.08</u> |

- (2) Overall uncertainty reported by EMSL.
- (3) The limit of detection for beta-particle-emitting impurities is $0.4 \text{ } \mu\text{s}^{-1}\text{g}^{-1}$ for energies greater than 20 keV.
- (4) NCRP Report No. 58, Second Edition (1985) p. 365.
- (5) This result demonstrates the traceability of EMSL to NIST, for this measurement, to within five percent as specified in the appendix, Traceability Studies, of the EPA-NIST interagency agreement of April 1976, as amended.

For further information call Larry Lucas at (301) 975-5546 or FTS 879-5546.

ISOTOPE WEIGHT DILUTION RECORD

Diluted

Isotope: ^3H Vendor: EPA

AA0022

Total Received Activity: 55.2 nanoCiVendor ID: 2548-1Wt. Received: ≈ 5.0 gNIST Traceable Y/N Cert. # implicitly traceableActivity in Units/g: 11.03 nanoCi/gReference Date: 8-10-1989Activity converted (dpm/g): 24486.6 dpm/gReceive Date: 7-23-93 N/A 8-23-19Half-life (Yrs or days) $t_{1/2}$ = 12.43 yearReceiver's Name: 7-23-93 N/A Jimmy

PRIMARY DILUTION:

Balance wt. check done ☒a: Source activity: 24486.6 dpm/g * (if $t_{1/2} < 100\text{yr}$ decay to prep. date)b: Wt. of Source transferred: 4.9376 g 8-10-89 decay correctedDiluent used: EPA dead waterto 6-18-1993c: Total diluted weight: 20.06 g $e^{-\lambda t} = .8055$ d: Activity of dilution ($a \cdot b/c$): 6027.17 dpm/ge: Calculated density of solution: 1.00 g/mL (4M $\text{HNO}_3 = 1.1294 \pm .0007 \text{ g/mL}$)f: Activity by volume = ($d \cdot e$): 6027.17 52545 dpm/mL 4859.6 dpm/mLDilution Log Book ID: 93-0475-1-1Preparation Date: 6-18-93 Preparer's Name: Agnes WongCAUTION
RADIOACTIVE MATERIAL
 SOLE 2 1 5
 AMT. 3 3 3
 ISOTOPE 3
 DATE 08/10/93; 046

SECONDARY OR WORKING LEVEL DILUTION

Balance wt. check done

 ENVIRONMENTAL MONITORING
 SYSTEMS LABORATORY - LAS VEGAS

Log Book ID of source being diluted: _____

a: Source activity: _____ dpm/g * (if $t_{1/2} < 100\text{yr}$ decay to prep. date)

b: Wt. of Source transferred: _____ g

Diluent used: _____

c: Total diluted weight: _____ g

d: Activity of dilution ($a \cdot b/c$): _____ dpm/ge: Calculated density of solution: _____ g/mL (4M $\text{HNO}_3 = 1.1294 \pm .0007 \text{ g/mL}$)f: Activity by volume = ($d \cdot e$): _____ dpm/mL

Dilution Log Book ID: _____

Preparer's Name: _____ Preparation Date: _____

Reviewed By: _____ Review Date: _____

ISOTOPE SECONDARY/WORKING LEVEL DILUTION RECORD

ISOTOPE: H-3 from NIST SOURCE, Y / NDate: 9/17/93 Preparer's Name: G. SumnerVolumetric Gravimetric Method (Circle One)Pipet Check / Balance Wt. Check Done (☒)Diluted Source ID (log#): 93-475-1-1

Diluent used: Deion Water if the diluent remains unchanged, then a weight dilution of a volume unit source can be performed without a density conversion.

Preparation of
Matrix Spike
Solution

A: Source activity: 4859.6 dpm/mL Ref Date 6-18-93B: Amount of source transferred: 11.7607 g used all remaining solutionC: Total amount of dilution: 121.78 gD: Activity of dilution (A*B/C): 469 dpm/mL on 6-18-93Dilution Log Book ID: LAL-93-474-18-1Reviewed by: BW Date: 9-17-93

DATA VALIDATION REPORT
for
200-BP-5 GROUNDWATER ROUND 3
Radiochemistry Analysis
SDG LK4482-LAS
LATA VB403.73

Bechtel Hanford Inc.
P.O. Box 969
Richland, Washington

July 27, 1995

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**200-BP-5 Groundwater Round 3
Data Validation Narrative**

INTRODUCTION

All samples in Sample Delivery Group (SDG) LK4482-LAS (VB403.73) were validated at level C as defined in the Data Validation Procedures for Radiochemical Analyses (WHC-SD-EN-SPP-001, Rev. 1).

The analyses were performed by Lockheed Analytical Services.

ANALYSES REQUESTED

See Table 1.

DATA QUALITY OBJECTIVES

| | |
|------------------------------------|--|
| Precision: | Goals for precision were met with the exception of those items discussed in the "Qualification Summary Table". |
| Accuracy: | Goals for accuracy were met. |
| Sample Result Verification: | Not applicable to summary data packages that contain no raw data. |
| Detection Limits: | Detection limit goals were met for all sample results as specified in the <i>Quality Assurance Program Plan for 200-BP-5 Groundwater Operable Unit</i> , DOE/RL 88-32, Rev. 1. with the exception of those items discussed in the "Qualification Summary Table". |
| Completeness: | The data package was 100% complete for all requested analyses. |

MAJOR DEFICIENCIES

No major deficiencies were identified during data validation which required qualification of data as unusable.

MINOR DEFICIENCIES

Minor deficiencies were identified during validation which required qualification of data as estimated. See the "Qualification Summary Table".

Table 1
Chain-of-Custody
Analysis Request

LATA ID #: VB403.73

SDG: LK4482-LAS

| Sample Information | | | | | | | Analyses Requested | | | | | | | | |
|--------------------|----------------|--------|---------|-------------------|---------------|---------|--------------------|---|---|---|---|---|---|---|---|
| SAMPLE NO. | DATE COLLECTED | MATRIX | SAF | SAMPLING LOCATION | FIELD QC INFO | TEMP °C | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| B0FKH6 | 9-May-95 | WATER | B95-050 | 299-E33-12 | SPLIT/B0FB90 | 2 | X | X | X | X | X | X | X | X | X |

Method References:

| Analysis | Method |
|---------------------------------------|-----------------|
| 1. Gross Alpha | LAL-91-SOP-0060 |
| 2. Gross Beta | LAL-91-SOP-0060 |
| 3. Plutonium-238, -239/40 | LAL-91-SOP-0108 |
| 4. Strontium-90 | LAL-91-SOP-0196 |
| 5. Gamma Spec (Cs-137, Co-60, Ru-106) | LAL-91-SOP-0063 |
| 6. Total Uranium | LAL-91-SOP-0060 |
| 7. Technetium-99 | LAL-91-SOP-0169 |
| 8. Tritium | LAL-91-SOP-0066 |
| 9. Activity Scan | Lab Specific |

NOTES: (complete documentation of these notes can be found in the Supplemental Information Section of this report)

NOTE 1: The Rad Screen before shipment was deemed unnecessary.

REFERENCES

WHC 1993, *Data Validation Procedures for Radiochemical Analyses*, WHC-SD-EN-SPP-001, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

DOE 1994, *Quality Assurance Program Plan for 200-BP-5 Groundwater Operable Unit*, DOE/RL 88-32, Rev. 1, Department of Energy-Hanford, Richland, Washington.

GLOSSARY OF VALIDATION APPLIED QUALIFIERS (RADIOCHEMISTRY)

Qualifiers which may be applied by data validators in compliance with the procedures herein are as follows.

- U-** Indicates the constituent was analyzed for, but was not detected at a concentration above the Minimum Detectable Activity (MDA). The concentration reported is the sample result corrected for sample aliquot size, dilution factors, and percent solids (in the case of solid matrices) by the laboratory. The associated data should be considered usable for decision making purposes.
- UJ-** Indicates the constituent was analyzed for and was not detected at a concentration above the Minimum Detectable Activity (MDA). Due to a quality control deficiency identified during data validation, the result reported may not accurately reflect the sample concentration. The associated data should be considered usable for decision making purposes.
- J-** Indicates a constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during validation. The data should be considered usable for decision making purposes.
- R-** Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision making purposes.
- UR-** Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision making purposes.

GLOSSARY OF LABORATORY APPLIED QUALIFIERS

Qualifiers which may be applied by the laboratory in compliance with applicable requirements are as follows.

Commonly used laboratory radiochemistry qualifiers:

- U- Indicates the analyte was analyzed for but not detected in the sample.
- J- Indicates the value reported is estimated due to the presence of interference.
- C- Indicates that the presence of high TDS in the sample required reduction of sample size which increased the MDA.

Qualification Summary Table

Qualification Summary Table

Radiochemistry

| ANALYTE | TYPE | QUALIFIER | SAMPLES AFFECTED | DQO | REASON |
|---------------|-------|-----------|---------------------|-----------|---|
| Technetium-99 | MINOR | J | B0FKH6 | PRECISION | Duplicate precision is outside acceptance criteria. |

Comments:

1. A matrix spike for the Technetium-99 procedure was not performed due to lack of sample. No qualification is necessary.
2. The "U" qualifiers added to the Data Summary Tables and Form Is are laboratory concentration qualifiers to indicate that the results are <MDA and have not been applied due to a validation deficiency.
3. The MDA was greater than RDL for the uranium-total analysis of sample B0FKH6. No qualification is necessary.

Radiochemistry Field QC

| ANALYTE | TYPE | QUALIFIER | FIELD QC SAMPLES | DQO | ASSESSMENT |
|------------|----------------|-----------|---------------------|-----------|--|
| Gross Beta | FIELD SPLIT QC | NONE | B0FKH6/B0FB90 | PRECISION | Field split precision is unacceptable. |

Comments:

1. Data qualification is not required based on field split precision, however field split results are noted here to alert the data user to uncertainties in the data set during decision making processes.

Data Summary Table

RADIOCHEMISTRY DATA SUMMARY TABLE

| | | | | |
|--------------------|------------|---------|----------|---|
| LATA ID#: VB403.73 | | HEIS #: | B0FKH6 | |
| | | Date: | 9-May-95 | |
| | | Matrix: | WATER | |
| Constituent | CAS # | Units | Results | Q |
| Technetium-99 | 14133-76-7 | pCi/L | 1560 | J |
| Tritium | 10028-17-8 | pCi/L | 360 | |
| Gross Alpha | ALPHA | pCi/L | 2.8 | C |
| Gross Beta | BETA | pCi/L | 883 | |
| Plutonium-238 | 13981-16-3 | pCi/L | -0.035 | U |
| Plutonium-239/240 | PU-239/240 | pCi/L | 0.05 | U |
| Total Strontium-90 | 10098-97-2 | pCi/L | -0.21 | U |
| Uranium-total | 7440-61-1 | µg/L | 3.31 | |

GAMMA-SCAN

| | | | | |
|-----------------------|------------|-------|------|---|
| Actinium-228 (Ra-228) | 15262-20-1 | pCi/L | 9 | U |
| Cesium-137 | 10045-97-3 | pCi/L | -7.2 | U |
| Cobalt-58 | 13981-38-9 | pCi/L | 2.7 | U |
| Cobalt-60 | 10198-40-0 | pCi/L | 24.4 | |
| Europium-152 | 14683-23-9 | pCi/L | -13 | U |
| Europium-154 | 15585-10-1 | pCi/L | -3 | U |
| Europium-155 | 14391-16-3 | pCi/L | -2.6 | U |
| Iron-59 | 14596-12-4 | pCi/L | 1.9 | U |
| Lead-212 | PB-212 | pCi/L | 5 | U |
| Lead-214 (Ra-226) | PB-214 | pCi/L | 12 | U |
| Radium-226 (Gamma) | 13982-63-3 | pCi/L | -100 | U |
| Ruthenium-106 | 13967-48-1 | pCi/L | 10 | U |
| U-235 (Gamma) | 15117-96-1 | pCi/L | -7 | U |

Sample Results (Form I's)

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0FKH6

LAL Sample ID: L4482-8

Date Collected: 09-MAY-95

Date Received: 11-MAY-95

Matrix: Water

Login Number: L4482

SDG: LK4482

| Constituent | Analyzed | Batch | Activity | Error | MDA | Data Qual | Units |
|-----------------------|-----------|----------------------------|----------|-------|------|-----------|-------|
| Ac-228(Ra-228) | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 9. | 26. | 41. | u | pCi/L |
| Co-58 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 2.7 | 5.1 | 8.6 | u | pCi/L |
| Co-60 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 24.4 | 7.9 | 8.9 | u | pCi/L |
| Cs-137 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -7.2 | 4.0 | 12. | u | pCi/L |
| Eu-152 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -13. | 13. | 49. | u | pCi/L |
| Eu-154 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -3. | 13. | 34. | u | pCi/L |
| Eu-155 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -2.6 | 6.4 | 19. | u | pCi/L |
| Fe-59 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 1.9 | 8.7 | 19. | u | pCi/L |
| Pb-212 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 5. | 12. | 16. | u | pCi/L |
| Pb-214(Ra-226) | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 12. | 13. | 18. | u | pCi/L |
| Ra-226(GAMMA) | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -100 | 130 | 190 | u | pCi/L |
| Ru-106 | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | 10. | 43. | 73. | u | pCi/L |
| U-235(GAMMA) | 31-MAY-95 | GAMMA SPEC LAL-0063_23211 | -7. | 30. | 44. | u | pCi/L |
| Gross Alpha | 12-JUN-95 | GR ALP/BETA LAL-0060_23215 | 2.8 | 2.0 | 2.7 | C | pCi/L |
| Gross Beta | 12-JUN-95 | GR ALP/BETA LAL-0060_23215 | 883. | 46. | 3.1 | u | pCi/L |
| Pu-238 | 12-JUN-95 | PU-ISOTOPIC LAL-0108_23154 | -0.035 | 0.034 | 0.19 | u | pCi/L |
| Pu-239/40 | 12-JUN-95 | PU-ISOTOPIC LAL-0108_23154 | 0.05 | 0.12 | 0.19 | u | pCi/L |
| Total radio-strontium | 09-JUN-95 | SR-90 LAL-0196_23179 | -0.21 | 0.42 | 0.75 | u | pCi/L |
| Uranium | 09-JUN-95 | U TOTAL KPA LAL-0168_23131 | 3.31 | 0.17 | 0.20 | u | ug/L |

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LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0FKH6

LAL Sample ID: L4482-17

Date Collected: 09-MAY-95

Date Received: 11-MAY-95

Matrix: Water

Login Number: L4482

| Constituent | Analyzed | Batch | Activity | Error | MDA | DataQual | Units |
|-------------|-----------|----------------------|----------|-------|-----|----------|-------|
| Tc-99 | 31-MAY-95 | TC-99 LAL-0169_23139 | 1560 | 130 | 7.1 | J | pCi/L |

7-24-95

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0FKH6

LAL Sample ID: L4482-16

Date Collected: 09-MAY-95

Date Received: 11-MAY-95

Matrix: Water

Login Number: L4482

| Constituent | Analyzed | Batch | Activity | Error | MDA | DataQual | Units |
|-------------|-----------|----------------------------|----------|-------|-----|----------|-------|
| H-3 | 26-MAY-95 | TRITIUM(H3) LAL-0066_23181 | 360 | 220 | 260 | | pCi/L |

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7-24-95

Checklist

**LATA RADIOCHEMISTRY
DATA VALIDATION CHECKLIST**

| VALIDATION LEVEL: | A | B | C | D | E |
|--|--|---|---|---|--|
| VALIDATION PROCEDURE: | <input type="checkbox"/> WHC-CM-5-3, Rev. 0 | | <input checked="" type="checkbox"/> WHC-SD-EN-SPP-001, Rev. 1 | | |
| PROJECT: 200-BP-5 ROUND 3 | | | SDG: LK4482-LAS | | |
| VALIDATOR: MC WEBB | LATA NO: VB403.73 | | DATE: 24-Jul-95 | | |
| REVIEWER: BJ MORRIS | LAB: LAS | | CASE: N/A | | |
| SAF NO: B95-050 | QAPP NO: N/A | | SAP NO: DOE/RL 88-32,R1 | | |
| ANALYSES REQUESTED | | | | | |
| <input checked="" type="checkbox"/> Gamma Spec LAL-91-SOP-0063 | <input checked="" type="checkbox"/> Gross Alpha LAL-91-SOP-0060 | <input checked="" type="checkbox"/> Gross Beta LAL-91-SOP-0060 | <input checked="" type="checkbox"/> Pu-238 Pu-239/240 LAL-91-SOP-0108 | <input checked="" type="checkbox"/> Strontium-90 LAL-91-SOP-0196 | <input checked="" type="checkbox"/> Technetium-99 LAL-91-SOP-0169 |
| <input checked="" type="checkbox"/> Uranium-total LAL-91-SOP-0168 | <input checked="" type="checkbox"/> Tritium LAL-91-SOP-0066 | | | | |
| SAMPLE NO. B0FKH6 | MATRIX WATER | COMMENTS: | | | |
| | | | | | |

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

YES NO N/A

Is technical verification documentation present?

☒ ☐ ☐

Is a case narrative present?

☒ ☐ ☐

2. HOLDING TIMES

YES NO N/A

Are sample holding times acceptable?

☒ ☐ ☐

Are samples preserved correctly?

☒ ☐ ☐

See HOLDING TIME SUMMARY form

3. INSTRUMENT PERFORMANCE AND CALIBRATIONS

YES NO N/A

Were instruments/detectors calibrated within one year of sample analysis?

☐ ☐ ☒

Are initial calibrations acceptable?

☐ ☐ ☒

Are standards NIST traceable?

☐ ☐ ☒

Are standards acceptable?

☐ ☐ ☒

Comments:

**LATA RADIOCHEMISTRY
DATA VALIDATION CHECKLIST**

4. CONTINUING CALIBRATION

Background checked at proper frequency?

YES NO N/A

☐ ☐ ☒

Background check acceptable?

☐ ☐ ☒

Efficiency checked at proper frequency?

☐ ☐ ☒

Efficiency check acceptable?

☐ ☐ ☒

Calibration check standards NIST traceable?

☐ ☐ ☒

Calibration check standards acceptable?

☐ ☐ ☒

If NO(s) are checked, see CALIBRATION DATA SUMMARY form

5. BLANKS

YES NO N/A

Were method blanks analyzed?

☒ ☐ ☐

Are the method blanks free of analytes?

☒ ☐ ☐

Were method blank results acceptable?

☒ ☐ ☐

Validation calculation/transcription checks were performed and are acceptable.

☐ ☐ ☒

If NO(s) are checked, see BLANK DATA SUMMARY form

6. ACCURACY

YES NO N/A

Were spike samples analyzed at the proper frequency?

☒ ☐ ☐

Are all spike sample recoveries acceptable?

☒ ☐ ☐

Were laboratory control standards (LCS) analyzed at the proper frequency?

☒ ☐ ☐

Are all LCS recoveries acceptable?

☒ ☐ ☐

Was a tracer/chemical carrier added?

☒ ☐ ☐

Was the tracer/chemical carrier recovery acceptable?

☒ ☐ ☐

Are standard sources traceable?

☐ ☐ ☒

Are standards acceptable?

☐ ☐ ☒

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

If NO(s) are checked, see ACCURACY DATA SUMMARY form

7. PRECISION

YES NO N/A

Were laboratory duplicates analyzed at the proper frequency?

☒ ☐ ☐

Are all duplicate RPD values acceptable?

☐ ☒ ☐

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

If NO(s) are checked, see PRECISION DATA SUMMARY form

**LATA RADIOCHEMISTRY
DATA VALIDATION CHECKLIST**

8. FIELD QC SAMPLES

YES NO N/A

Were field QC samples (field/trip blanks, duplicates, splits, performance audit) identified?

☒ ☐ ☐

Are field/trip blank results acceptable? (see Blank Data Summary form)

☐ ☐ ☒

Are field duplicate RPD values acceptable? (see Field QC calculations)

☐ ☐ ☒

Are field split RPD values acceptable? (see Field QC calculations)

☐ ☒ ☐

Are performance audit sample results acceptable?

☐ ☐ ☒

Comments: B0FKH6 is a split with B0FB90. The split is evaluated in this package.

B0FB90 was validated in SDG W0548-QES (VB403.71).

9. REPORTED RESULTS AND DETECTION LIMITS

YES NO N/A

Are results reported for all requested analyses?

☒ ☐ ☐

Are all results supported in the raw data?

☐ ☐ ☒

Are results calculated properly?

☐ ☐ ☒

Do MDAs meet the RDLs?

☐ ☒ ☐

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

Comments: The MDA >RDL for the uranium-total analysis of sample B0FKH6. No qualification is necessary.

VALIDATION SUMMARY

For deficiencies (major and minor) and comments, please refer to the Qualification Summary Table.

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**LATA RADIOCHEMISTRY
DATA VALIDATION CHECKLIST**

HOLDING TIME SUMMARY

| SDG: LK4482-LAS | | | VALIDATOR: MC WEBB | | | | | DATE: 24-Jul-95 | | |
|---------------------------|-------------|----------------------|---------------------|-----------|---------------|----------------|--------------------|--------------------|--------------------|-------|
| PROJECT: 200-BP-5 ROUND 3 | | | REVIEWER: BJ MORRIS | | | | | LATA NO.: VB403.73 | | |
| HEIS-SN | MATRIX CODE | ANALYSIS | DATE COLLECTED | PREP DATE | ANALYSIS DATE | PREP HT (days) | Required HT (days) | ANALYSIS HT (days) | Required HT (days) | VAL Q |
| B0FKH6 | WATER | Uranium-total | 9-May-95 | N/A | 09-Jun-95 | N/A | N/A | 31 | 180 | NONE |
| B0FKH6 | WATER | Technetium-9 | 9-May-95 | N/A | 31-May-95 | N/A | N/A | 22 | 180 | NONE |
| B0FKH6 | WATER | Pu-238 Pu-239/240 | 9-May-95 | N/A | 12-Jun-95 | N/A | N/A | 34 | 180 | NONE |
| B0FKH6 | WATER | Strontium-90 | 9-May-95 | N/A | 09-Jun-95 | N/A | N/A | 31 | 180 | NONE |
| B0FKH6 | WATER | Tritium | 9-May-95 | N/A | 26-May-95 | N/A | N/A | 17 | 180 | NONE |
| B0FKH6 | WATER | Gamma Scan | 9-May-95 | N/A | 31-May-95 | N/A | N/A | 22 | 180 | NONE |
| B0FKH6 | WATER | Gross Alpha | 9-May-95 | N/A | 12-Jun-95 | N/A | N/A | 34 | 180 | NONE |
| B0FKH6 | WATER | Gross Beta | 9-May-95 | N/A | 12-Jun-95 | N/A | N/A | 34 | 180 | NONE |

**LATA RADIOCHEMISTRY
DATA VALIDATION CHECKLIST**

PRECISION DATA SUMMARY

| SDG: LK4482-LAS | | | | | VALIDATOR: MC WEBB | | | | | DATE: 24-Jul-95 | |
|---------------------------|---------------|-----------------|----------|-----------------|---------------------|-------|-----|------------------|---------------------|---------------------|----------|
| PROJECT: 200-BP-5 ROUND 3 | | | | | REVIEWER: BJ MORRIS | | | | | LATA NO.: VB403.73 | |
| HEIS-SN | ANALYTE | ORIG RESULTS | LAB Q | DUPE RESULTS | LAB Q | UNITS | RDL | DUPE RPD % | DUPE CRDL dif | SAMPLES AFFECTED | VAL Q |
| B0FKH6 | Technetium-99 | 1560 | | 2020 | | pCi/L | 15 | 25.7 | | B0FKH6 | J |
| B0FKH6 | Cesium-137 | -7.17 | U | 4.79 | U | pCi/L | 15 | | 4.79 | NONE | NONE |

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PNO-DVF-015, R2

LOCKHEED ANALYTICAL SERVICES

RADIOCHEMISTRY ANALYTES

QC Data Summary For Duplicate Sample Analysis

Login Number: L4482

| Analyte | Batch ID | Client ID | LAL ID | Date Analyzed | Sample Result | Error 2 Sigma | Duplicate Result | Error 2 Sigma | RER | RPD | Q |
|--------------|----------|-----------|----------|---------------|---------------|---------------|------------------|---------------|-------|-------|---|
| Uranium | 23131 | BOFKH6 | L4482-8 | 06/09/95 | 3.31 | 0.171 | 3.08 | 0.159 | 0.692 | 7.2 | |
| Tc-99 | 23139 | BOFBK3 | L4467-6 | 05/31/95 | 45.4 | 8.78 | 50.6 | 9.29 | 1.57 | 10.8 | |
| Tc-99 | 23139 | BOFKH6 | L4482-17 | 05/31/95 | 1560 | 128 | 2020 | 163 | 1.57 | 25.7 | * |
| Pu-238 | 23154 | BOFKH6 | L4482-8 | 06/12/95 | -0.0349 μ | 0.0343 | -0.0527 μ | 0.103 | 0.129 | 40.6 | |
| Pu-239/40 | 23154 | BOFKH6 | L4482-8 | 06/12/95 | 0.0489 μ | 0.121 | 0.758 | 0.859 | 0.724 | 176 | |
| Total radio | 23179 | BOFKH6 | L4482-8 | 06/09/95 | -0.213 μ | 0.417 | -0.154 μ | 0.43 | 0.07 | 32.2 | |
| Cs-137 | 23211 | BOFBK3 | L4467-2 | 05/31/95 | 2.94 | 8.14 | 1.9 | 5.72 | 0.08 | 43 | |
| Pb-214(Ra-2) | 23211 | BOFBK3 | L4467-2 | 05/31/95 | 8.79 | 13.7 | 7.97 | 13.8 | 0.03 | 9.79 | |
| Cs-137 | 23211 | BOFKH6 | L4482-8 | 05/30/95 | -7.17 μ | 3.96 | 4.79 μ | 7.31 | 1.06 | 1010 | * |
| Pb-214(Ra-2) | 23211 | BOFKH6 | L4482-8 | 05/30/95 | 12.3 μ | 13.2 | 6.32 μ | 13.9 | 0.22 | 64.2 | |
| Gross Alpha | 23215 | BOFKH6 | L4482-8 | 06/12/95 | 2.82 | 1.99 | 3.05 | 1.99 | 0.058 | 7.84 | |
| Gross Beta | 23215 | BOFKH6 | L4482-8 | 06/12/95 | 883 | 46.5 | 885 | 46.6 | 0.021 | 0.226 | |

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RADIOCHEMISTRY SPLIT EVALUATION

| LATA ID#: VB403.73 | | HEIS #: | B0FKH6 | | B0FB90 | | RPD W >20% S >35% | DIF W >DL S >2*DL | DL SAME UNITS AS RESULTS |
|--------------------|------------|---------|----------|---|----------|---|-------------------------|-------------------------|-----------------------------------|
| | | Date: | 9-May-95 | | 9-May-95 | | | | |
| | | Matrix: | WATER | | WATER | | | | |
| | | | ORIGINAL | | SPLIT | | | | |
| Constituent | CAS # | Units | Results | Q | Results | Q | | | |
| Technetium-99 | 14133-76-7 | pCi/L | 1560 | | 1490 | | 4.6% | | 15 |
| Tritium | 10028-17-8 | pCi/L | 360 | | 458 | | | 98 | 400 |
| Gross Alpha | ALPHA | pCi/L | 2.8 | C | 2.36 | | | 0.44 | 3 |
| Gross Beta | BETA | pCi/L | 883 | | 206 | | 124.3% | | 4 |
| Plutonium-238 | 13981-16-3 | pCi/L | -0.035 | U | -0.123 | U | | | |
| Plutonium-239/240 | PU-239/240 | pCi/L | 0.05 | U | 0.246 | U | | | |
| Strontium-90 | 10098-97-2 | pCi/L | -0.21 | U | -0.15 | U | | | |
| Uranium-total | 7440-61-1 | µg/L | 3.31 | | 2.99 | | 10.2% | | 0.1 |

GAMMA-SCAN

| | | | | | | | | | |
|----------------------|------------|-------|------|---|--------|---|--|-----|----|
| Actinum-228 (Ra-228) | 15262-20-1 | pCi/L | 9 | U | N/A | | | | |
| Cesium-137 | 10045-97-3 | pCi/L | -7.2 | U | -7.05 | U | | | |
| Cobalt-58 | 13981-38-9 | pCi/L | 2.7 | U | -7.28 | U | | | |
| Cobalt-60 | 10198-40-0 | pCi/L | 24.4 | | 31.4 | | | 7.0 | 15 |
| Europium-152 | 14683-23-9 | pCi/L | -13 | U | 3.13 | U | | | |
| Europium-154 | 15585-10-1 | pCi/L | -3 | U | -0.807 | U | | | |
| Europium-155 | 14391-16-3 | pCi/L | -2.6 | U | 8.88 | U | | | |
| Iron-59 | 14596-12-4 | pCi/L | 1.9 | U | -10.3 | U | | | |
| Lead-212 | PB-212 | pCi/L | 5 | U | N/A | | | | |
| Lead-214 (Ra-226) | PB-214 | pCi/L | 12 | U | N/A | | | | |
| Radium-226 (Gamma) | 13982-63-3 | pCi/L | -100 | U | N/A | | | | |
| Ruthenium-106 | 13967-48-1 | pCi/L | 10 | U | 18.6 | U | | | |
| U-235 (Gamma) | 15117-96-1 | pCi/L | -7 | U | N/A | | | | |

EVALUATION:

1. Field duplicates are not evaluated for precision if both results are non-detect.
2. If both sample results are >5*DL the RPD is used for evaluation.
3. If either sample result is <5*DL the DIF is used for evaluation.
4. Shaded values in the RPD or DIF column indicate a constituent that is outside acceptance criteria.
5. All other positive results have exhibited acceptable precision.

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Laboratory Case Narrative

CASE NARRATIVE RADIOCHEMICAL ANALYSES

The routine calibration and quality control analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, duplicate samples.

Holding Time Requirements

All holding time requirements were met.

Chemical recoveries and MDAs, where applicable, can be found on the preparation and calculation worksheets of the attached raw data for each method.

Analytical Method

Gamma Spectrum Analysis

The gamma spectrum analysis was performed using LAL-91-SOP-0063. All samples were analyzed on batch #23211, which contains a method blank (MB), two duplicates (DUP1, DUP2), and a laboratory control sample (LCS). The DUP2 for Cs-137 was out of limits; however, since the Cs-137 DUP1 and both Pb-214 duplicates were within limits, the data is considered acceptable. All other QC criteria were met.

Gross Alpha Beta

The gross alpha beta analysis was performed using LAL-91-SOP-0060. All samples were analyzed on batch #23215, which contains an MB, DUP and LCS. No problems were encountered during preparation or analysis, and all QC criteria were met.

Plutonium Isotopic

The plutonium isotopic analysis was performed using LAL-91-SOP-0108. All samples were analyzed on batch #23154, which contains an MB, DUP and LCS. The duplicate (sample #23154DUP1) has a poor chemical recovery and only three counts. The duplicate uncertainty shows that the detected value is not significantly different from zero. No matrix spike analysis (MS) was performed due to insufficient sample. All other QC criteria were met.

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Strontium-90

The strontium-90 analysis was performed using LAL-91-SOP-0196. All samples were analyzed on batch #23179, which contains an MB, DUP and LCS. During preparation, the samples were wetashed under the heat lamp with concentrated HNO₃ to get rid of the excess organic materials. This was done in the original conical planchets. After they were dried, they were reweighed. There was insufficient sample for an MS analysis. All other QC criteria were met.

Technetium-99

The technetium-99 analysis was performed using LAL-91-SOP-0169. All samples were analyzed on batch #23139, which contains an MB, DUP1, DUP2, and LCS. The second duplicate (DUP2) was out of limits; however, since DUP1 was within limits, the data is considered acceptable. No matrix spike analysis was performed due to insufficient sample. All other QC criteria were met.

Total Uranium

The total uranium analysis was performed using LAL-91-SOP-0168. All samples were analyzed on batch #23131, which contains an MB, DUP, LCS and MS. No problems were encountered during preparation or analysis, and all QC criteria were met.

Tritium

The tritium analysis was performed using LAL-91-SOP-0066. All samples were analyzed on batch #23181, which contains an MB, DUP, LCS and MS. No problems were encountered during preparation or analysis, and all QC criteria were met.

Yvonne M. Jacoby
Prepared By

June 20, 1995 *am*
Date *7-25-95*

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Chain-of-Custody Information

Bechtel Hanford, Inc.

L4482

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

Page 1 of 1

Data Turnaround

☐ Priority☒ Normal

| | | |
|---|--|---|
| Collector K. Lee | Company Contact G.L. Kasza | Telephone (509) 372-9675 |
| Project Designation 200-BP-5 Groundwater Round 3 | Sampling Location 200 East | SAF No. B95-049 |
| Ice Chest No. SML-371 | Field Logbook No. ZFL-1129 | Method of Shipment Federal Express |
| Shipped To Lockheed | Offsite Property No. W95-0-03041-29 | Bill of Lading/Air Bill No. 2904627344 |

| | | | | | | | | | | | |
|--|---------------------|--|------------|----------|----------|------|---------|----------|------------------|----------|------|
| Possible Sample Hazards/Remarks | Preservation | HNO3 | Cool 4°C | Cool 4°C | Cool 4°C | NaOH | HNO3 | Cool 4°C | HCl | Cool 4°C | HNO3 |
| | Type of Container | P/G | G | P | P | P | P/G | G | P | P | P/G |
| | No. of Container(s) | 1 | 1 | 1 | 1 | 2 | 8 | 1 | 4 | 1 | 1 |
| Special Handling and/or Storage Maintain samples between 2°C and 6°C. | Volume | 1L | 500mL | 250mL | 500mL | 1L | 1L | 500mL | 1L | 20mL | 1L |
| SAMPLE ANALYSIS | *1 | Anions (IC- F, Co, SO4, NO2, NO3, PO4 | Alkalinity | TDS | Cyanide | *2 | Tritium | Tc-99 | Activity Scan | *3 | |

| Sample No. | Matrix* | Date Sampled | Time Sampled | | | | | | | | | |
|------------|---------|--------------|--------------|---|---|---|---|---|---|---|---|---|
| BOFKH6 | U | 5-9-95 | 1102 | X | X | X | X | X | X | X | X | |
| BOFKH7 | U | 5-9-95 | 1102 | | | | | | | | | X |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
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| | | | |
|---|--|---|-------------------|
| CHAIN OF POSSESSION | Sign/Print Names | SPECIAL INSTRUCTIONS | Matrix* |
| Relinquished By <i>K. Lee</i> Date/Time <i>5/9/95 1400</i> | Received By <i>ERC</i> Date/Time <i>1400</i> | *1 ICP Metals - to include Ca, Mg, Na, K, Fe, Mn, Si, Al, and Bi. AA Metals - to include Se (unfiltered). | S = Soil |
| Relinquished By <i>ERC</i> Date/Time <i>0900</i> | Received By <i>Bill Miller Bwh.Haw</i> Date/Time <i>5-9-95</i> | *2 Gross Alpha; Gross Beta; Pu-238, 239/240; Sr-90; Gamma Spec - to include Cs-137, Co-60, Ru-106; Total Uranium. | SE = Sediment |
| Relinquished By <i>Bill Miller Bwh.Haw</i> Date/Time <i>5-10-95</i> | Received By _____ Date/Time _____ | *3 ICP Metals - to include Ca, Mg, Na, K, Fe, Mn, Si, Al, and Bi. AA Metals - to include Se (filtered). | SO = Solid |
| Relinquished By _____ Date/Time _____ | Received By _____ Date/Time _____ | Sample analysis for PO4, NO2, NO3 by EPA 300.0 is being requested for information only. The ERC Contractor acknowledges that the 48-hour hold time will not be met. | SL = Sludge |
| Relinquished By _____ Date/Time _____ | Received By _____ Date/Time _____ | The Activity Scan is for both sample numbers listed on this chain of custody. | W = Water |
| | | | O = Oil |
| | | | A = Air |
| | | | DS = Drum Solids |
| | | | DL = Drum Liquids |
| | | | T = Tissue |
| | | | WJ = Wipe |
| | | | L = Liquid |
| | | | V = Vegetation |
| | | | X = Other |

| | | | |
|--------------------------|--------------------------------|-------------------------------|---------------------------------|
| LABORATORY SECTION | Received By <i>Bill Miller</i> | Title <i>Sample Custodian</i> | Date/Time <i>5-11-95 / 0845</i> |
| FINAL SAMPLE DISPOSITION | Disposal Method <i>000000</i> | Disposed By | Date/Time |

Supplemental Information

Environmental
Restoration
Contractor

ERC Team
Interoffice Memorandum

Job No. 22192
Written Response Required: NO
CCN: N/A
OU: 200-BP-5
TSD: N/A
ERA: N/A
Subject Code: 1995 Round 3 Sampling

TO: W. S. Thompson N3-06 DATE: April 21, 1995
COPIES: D. B. Erb H5-01 FROM: S. K. De Mers
Radiological Controls
N3-06/376-2764

SUBJECT: 1995 Round 3 sampling for 200-BP-5

There is no need to perform total activities prior to offsite shipment to NRC licensed labs of samples taken from the attached list of wells.

The wells listed in the attachment were reviewed for radiological content based on the previous 4 years of sampling data. No well listed has a β activity in excess of 100,000 pCi/l ($< .1$ uCi/sample based on a 1 liter sample size) nor any α activity in excess of 10,000 pCi/l ($< .01$ uCi/l based on a 1 liter sample). All wells show activities $< 2,000$ pCi/gm (< 2 nCi/gm D.O.T. limit). The highest activity in recent samples is 17,000 pCi/l β and 170 pCi/l α .

Radiological monitoring during sampling will only be required if the wells are located in radiological areas or if the wells themselves are labeled with radiological stickers. Monitoring requirements for down hole work such as pump removal will be determined based on the history of each well on a case by case basis.

skd

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~~020~~

7-25-95
2511271

END OF PACKAGE

DATA VALIDATION REPORT
for
200-BP-5 GROUNDWATER ROUND 3
General Chemistry Analysis
SDG LK4482-LAS
LATA VB403.73

Bechtel Hanford Inc.
P. O. Box 969
Richland, Washington

July 27, 1995

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**200-BP-5 Groundwater Round 3
Data Validation Narrative**

INTRODUCTION

All samples in Sample Delivery Group (SDG) LK4482-LAS (VB403.73) were validated at level "C" as defined in the Data Validation Procedures for Chemical Analysis (WHC-SD-EN-SPP-002, Rev. 2).

The analyses were performed by Lockheed Analytical Services.

ANALYSES REQUESTED

See Table 1.

DATA QUALITY OBJECTIVES

| | |
|------------------------------------|--|
| Precision: | Goals for precision were met. |
| Accuracy: | Goals for accuracy were met. |
| Sample Result Verification: | Not applicable to summary data packages that contain no raw data. |
| Detection Limits: | Detection limit goals were met for all sample results as specified in the <i>Quality Assurance Program Plan for 200-BP-5 Groundwater Operable Unit</i> , DOE/RL 88-32, Rev. 1. |
| Completeness: | The data package was 100% complete for all requested analyses. |

MAJOR DEFICIENCIES

No major deficiencies were identified during data validation which required qualification of data as unusable.

MINOR DEFICIENCIES

No minor deficiencies were identified during data validation which required qualification of data as estimated.

Table 1
Chain-of-Custody
Analysis Request

LATA ID #: VB403.73

SDG: LK4482-LAS

| Sample Information | | | | | | | Analyses Requested | | | |
|--------------------|----------------|--------|---------|-------------------|---------------|---------|--------------------|---|---|---|
| SAMPLE NO. | DATE COLLECTED | MATRIX | SAF | SAMPLING LOCATION | FIELD QC INFO | TEMP °C | 1 | 2 | 3 | 4 |
| B0FKH6 | 9-May-95 | WATER | B95-049 | 299-E33-12 | SPLIT/B0FB90 | 2 | X | X | X | X |

Method References:

- | <u>Analysis</u> |
|---|
| 1. Anions (F, Cl, SO ₄ , PO ₄ , NO ₂ , NO ₃) |
| 2. Alkalinity |
| 3. TDS |
| 4. Cyanide |

| <u>Method</u> |
|---------------|
| 300.0 |
| 310.1 |
| 160.1 |
| CLP |

REFERENCES

WHC 1993, *Data Validation Procedures for Chemical Analyses*, WHC-SD-EN-SPP-002, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

DOE 1994, *Quality Assurance Program Plan for 200-BP-5 Groundwater Operable Unit*, DOE/RL 88-32, Rev. 1, Department of Energy-Hanford , Richland, Washington.

GLOSSARY OF VALIDATION APPLIED QUALIFIERS (CHEMISTRY)

Qualifiers which may be applied by data validators in compliance with the procedures herein are as follows.

- U- Indicates the compound or analyte was analyzed for and not detected in the sample. The value reported is the sample quantitation limit corrected for sample dilution and moisture content by the laboratory.
- UJ- Indicates the compound or analyte was analyzed for and not detected in the sample. Due to a QC deficiency identified during data validation, the associated quantitation limit is an estimate.
- J- Indicates the compound or analyte was analyzed for and detected. The associated concentration is an estimate, but the data are usable for decision making purposes.
- BJ- Applied to inorganic analyses only. Indicates the analyte concentration was greater than the IDL but less than the CRDL and is considered an estimated value.
- R- Indicates the compound or analyte was analyzed for, detected, and due to an identified QC deficiency the data are unusable.
- UR- Indicates the compound or analyte was analyzed for and not detected in the sample. Additionally, the data are unusable due to an identified QC deficiency.

GLOSSARY OF LABORATORY APPLIED QUALIFIERS

Qualifiers which may be applied by the laboratory in compliance with applicable requirements are as follows.

Commonly used laboratory general chemistry qualifiers:

- U- Indicates the analyte was analyzed for but not detected in the sample.
- D- Indicates a dilution was performed.

Qualification Summary Table

Qualification Summary Table

General Chemistry

| ANALYTE | TYPE | QUALIFIER | SAMPLES AFFECTED | DQO | REASON |
|---|------|-----------|---------------------|-----|--------|
| No qualifiers were added by the validator | | | | | |

General Chemistry Field QC

| ANALYTE | TYPE | QUALIFIER | FIELD QC SAMPLES | DQO | ASSESSMENT |
|---------|----------|-----------|---------------------|-----------|-------------------------------------|
| All | FIELD QC | NONE | B0FKH6/B0FB90 | PRECISION | Field split precision is acceptable |

Comments:

1. Data qualification is not required based on field split precision, however field split results are noted here to alert the data user to uncertainties in the data set during decision making processes.

Data Summary Table

**GENERAL CHEMISTRY
DATA SUMMARY TABLE**

| LATA ID#: VB403.73 | | HEIS #: | B0FKH6 | |
|------------------------|------------|---------|----------|---|
| | | Date: | 9-May-95 | |
| | | Matrix: | WATER | |
| Constituent | CAS # | Units | Results | Q |
| Total Dissolved Solids | TDS | mg/L | 280 | |
| Chloride by IC | 16887-00-6 | mg/L | 8.5 | |
| Fluoride by IC | 16984-48-8 | mg/L | 0.33 | |
| Nitrate-N by IC | 14797-55-8 | mg/L | 11 | |
| Nitrite-N by IC | 14797-65-0 | mg/L | 0.002 | U |
| Ortho Phosphate by IC | 14265-44-2 | mg/L | 0.020 | U |
| Sulfate by IC | 14808-79-8 | mg/L | 16 | |
| Alkalinity, total | ALKALINITY | mg/L | 110 | |
| Bicarbonate Alkalinity | 188 | mg/L | 110 | |
| Carbonate Alkalinity | 189 | mg/L | 10 | U |
| Cyanide, total | CYANIDE | mg/L | 0.034 | |

Sample Results (Form I's)

LOCKHEED ANALYTICAL SERVICES

Sample Results

| | |
|--------------------------|---------------------------|
| Client Sample ID: B0FKH6 | Date Collected: 09-MAY-95 |
| Matrix: Water | Date Received: 11-MAY-95 |
| Percent Solids: N/A | |

| Constituent | Units | Method | Result | Project Reporting Limit | Data Qualifier(s) | Date Analyzed | LAS Batch ID | LAS Sample ID |
|---|-------|--------|---------|-------------------------|-------------------|---------------|--------------|---------------|
| Total Dissolved Solids | mg/L | 160.1 | 280 | 40. | | 16-MAY-95 | 22839 | L4482-5 |
| Chloride | mg/L | 300.0 | 8.5 | 0.020 | | 11-MAY-95 | 22732 | L4482-3 |
| Fluoride | mg/L | 300.0 | 0.33 | 0.10 | | 11-MAY-95 | 22737 | L4482-3 |
| Nitrate-N | mg/L | 300.0 | 11. | 0.020 | | 11-MAY-95 | 22733 | L4482-3 |
| Nitrite-N | mg/L | 300.0 | < 0.002 | 0.010 | U | 11-MAY-95 | 22734 | L4482-3 |
| Ortho Phosphate | mg/L | 300.0 | < 0.020 | 0.10 | U | 11-MAY-95 | 22736 | L4482-3 |
| Sulfate | mg/L | 300.0 | 16. | 0.10 | | 11-MAY-95 | 22735 | L4482-3 |
| Alkalinity, total (as CaCO ₃) | mg/L | 310.1 | 110 | 30. | | 16-MAY-95 | 22859 | L4482-4 |
| Bicarbonate Alka as CaCO ₃ | mg/L | 310.1 | 110 | 30. | | 16-MAY-95 | 22859 | L4482-4 |
| Carbonate Alka as CaCO ₃ | mg/L | 310.1 | < 10. | 30. | U | 16-MAY-95 | 22859 | L4482-4 |
| Total Cyanide | mg/L | CLP | 0.034 | 0.020 | D(1:2) | 16-MAY-95 | 22874 | L4482-6 |

b15 7-19-95

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026

Checklist

**LATA GENERAL CHEMISTRY
DATA VALIDATION CHECKLIST**

| VALIDATION LEVEL: | A | B | C | D | E |
|---|---|--|---|---|---|
| VALIDATION PROCEDURE: | <input type="checkbox"/> WHC-CM-5-3, Rev. 0 | | <input checked="" type="checkbox"/> WHC-SD-EN-SPP-002, Rev. 2 | | |
| PROJECT: 200-BP-5 ROUND 3 | | | SDG: LK4482-LAS | | |
| VALIDATOR: BJ SEYMOUR <i>bj 7-26-95</i> | LATA NO: VB403.73 | | DATE: 19-Jul-95 | | |
| REVIEWER: BJ MORRIS <i>bj 7-26-95</i> | LAB: LAS | | CASE: N/A | | |
| SAF NO: B95-049 | QAPP NO: N/A | | SAP NO: DOE/RL 88-32,R1 | | |
| ANALYSES REQUESTED | | | | | |
| <input checked="" type="checkbox"/> Anions 300.0 | <input checked="" type="checkbox"/> Alkalinity 310.1 | <input checked="" type="checkbox"/> TDS 160.1 | <input checked="" type="checkbox"/> Cyanide CLP | | |
| SAMPLE NO. MATRIX B0FKH6 WATER | | COMMENTS: | | | |

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

YES NO N/A

Is technical verification documentation present?

☒ ☐ ☐

Is a case narrative present?

☒ ☐ ☐

2. HOLDING TIMES

YES NO N/A

Are sample holding times acceptable?

☒ ☐ ☐

See **HOLDING TIME SUMMARY** form

3. INSTRUMENT PERFORMANCE AND CALIBRATIONS

YES NO N/A

Were initial calibrations performed on all instruments?

☐ ☐ ☒

Are initial calibrations acceptable?

☐ ☐ ☒

Were calibration checks performed on all instruments?

☐ ☐ ☒

Are calibration checks acceptable?

☐ ☐ ☒

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

If NO(s) are checked, see **CALIBRATION DATA SUMMARY** form

**LATA GENERAL CHEMISTRY
DATA VALIDATION CHECKLIST**

4. BLANKS

- Were laboratory blanks performed for all applicable analyses?
- Are laboratory blank results acceptable?
- Were preparation blanks analyzed?
- Are preparation blank results acceptable?

| YES | NO | N/A |
|-------------------------------------|--------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

If NO(s) are checked, see BLANK AND SAMPLE DATA SUMMARY form

5. ACCURACY

- Were spike samples analyzed at the proper frequency?
- Are all spike sample recoveries acceptable?
- Were laboratory control samples (LCS) analyzed at the proper frequency?
- Are all LCS recoveries acceptable?
- Validation calculation checks were performed and are acceptable.

| YES | NO | N/A |
|-------------------------------------|--------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

If NO(s) are checked, see ACCURACY DATA SUMMARY form

6. PRECISION

- Were laboratory duplicates analyzed at the proper frequency?
- Are all duplicate RPD values acceptable?
- Were MS/MSDs analyzed?
- Are all MS/MSD RPD values acceptable?
- Validation calculation checks were performed and are acceptable.

| YES | NO | N/A |
|-------------------------------------|--------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

If NO(s) are checked, see PRECISION DATA SUMMARY form

7. FIELD QC SAMPLES

- Were field QC samples (field/trip blanks, duplicates, splits, performance audit) identified?
- Are field/trip blank results acceptable? (see Blank Data Summary form)
- Are field duplicate RPD values acceptable? (see Field QC calculations)
- Are field split RPD values acceptable? (see Field QC calculations)
- Are performance audit sample results acceptable?

| YES | NO | N/A |
|-------------------------------------|--------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Comments: B0FKH6 is a field split with B0FB90

The field split is evaluated in this package.

B0FB90 was validated in SDG W0548-QES (VB403.71).

**LATA GENERAL CHEMISTRY
DATA VALIDATION CHECKLIST**

8. ANALYTE QUANTITATION

YES NO N/A

Was analyte quantitation performed properly?

☐ ☐ ☒

Are results calculated properly?

☐ ☐ ☒

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

Comments:

9. REPORTED RESULTS AND DETECTION LIMITS

YES NO N/A

Are results reported for all requested analyses?

☒ ☐ ☐

Are all results supported in the raw data?

☐ ☐ ☒

Do results meet the CRDLs?

☒ ☐ ☐

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

Comments:

VALIDATION SUMMARY

For deficiencies (major and minor) and comments, please refer to the Qualification Summary Table.

LATA GENERAL CHEMISTRY
DATA VALIDATION CHECKLIST

HOLDING TIME SUMMARY

| SDG: LK4482-LAS | | | VALIDATOR: BJ SEYMOUR | | | | | DATE: 19-Jul-95 | | |
|---------------------------|-------------|---|-----------------------|-----------|---------------|----------------|--------------------|--------------------|--------------------|-------|
| PROJECT: 200-BP-5 ROUND 3 | | | REVIEWER: BJ MORRIS | | | | | LATA NO.: VB403.73 | | |
| HEIS-SN | MATRIX CODE | ANALYSIS | DATE COLLECTED | PREP DATE | ANALYSIS DATE | PREP HT (days) | Required HT (days) | ANALYSIS HT (days) | Required HT (days) | VAL Q |
| BOFKH6 | WATER | TDS | 9-May-95 | N/A | 16-May-95 | N/A | N/A | 7 | 7 | NONE |
| BOFKH6 | WATER | Alkalinity | 9-May-95 | N/A | 16-May-95 | N/A | N/A | 7 | 14 | NONE |
| BOFKH6 | WATER | Cyanide | 9-May-95 | N/A | 16-May-95 | N/A | N/A | 7 | 14 | NONE |
| BOFKH6 | WATER | Anions (Cl,F,SO ₄) | 9-May-95 | N/A | 11-May-95 | N/A | N/A | 2 | 28 | NONE |
| BOFKH6 | WATER | Anions (NO ₂ ,NO ₃ ,PO ₄) | 9-May-95 | N/A | 11-May-95 | N/A | N/A | 2 | 2 | NONE |

000017

GENERAL CHEM FIELD SPLIT EVALUATION

| LATA ID#: VB403.73 | | HEIS #: | B0FB90 | B0FKH6 | RPD | | DIF | DL |
|------------------------|------------|---------|----------|----------|---------|---|---------|----------|
| | | Date: | 9-May-95 | 9-May-95 | W >20% | | W >DL | SAME |
| | | Matrix: | WATER | WATER | S >35% | | S >2*DL | |
| | | | ORIGINAL | SPLIT | | | | UNITS AS |
| Constituent | CAS # | Units | Results | Q | Results | Q | | RESULTS |
| Total Dissolved Solids | TDS | mg/L | 266 | | 280 | | 5.1% | 5.0 |
| Chloride by IC | 16887-00-6 | mg/L | 7.89 | | 8.5 | | 7.4% | 0.5 |
| Fluoride by IC | 16984-48-8 | mg/L | 0.10 | | 0.33 | | | 0.5 |
| Nitrate-N by IC | 14797-55-8 | mg/L | 11.8 | J | 11 | | 0.23 | 2.5 |
| Nitrite-N by IC | 14797-65-0 | mg/L | 0.020 | UR | 0.002 | U | 0.80 | |
| Ortho Phosphate by IC | 14265-44-2 | mg/L | 0.5 | UR | 0.020 | U | | |
| Sulfate by IC | 14808-79-8 | mg/L | 16 | | 16 | | 1.3% | 0.5 |
| Alkalinity, total | ALKALINITY | mg/L | 102 | | 110 | | 7.5% | 10.0 |
| Bicarbonate Alkalinity | 188 | mg/L | N/A | | 110 | | | |
| Carbonate Alkalinity | 189 | mg/L | N/A | | 10 | U | | |
| Cyanide, total | CYANIDE | mg/L | 0.021 | J | 0.034 | | 0.013 | 0.01 |

EVALUATION:

1. Field split is not evaluated for precision if both results are non-detect.
2. If both sample results are >5*DL the RPD is used for evaluation.
3. If either sample result is <5*DL the DIF is used for evaluation.
4. All positive results have exhibited acceptable precision.

000018

Laboratory Case Narrative

CASE NARRATIVE INORGANIC NON METALS ANALYSES

The routine calibration and quality control analyses performed for this batch include as applicable: instrument tune (ICP/MS only), initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), ICP interference check samples (ICP only), serial dilutions, analytical (post-digestion) spike samples, matrix spike (predigestion) sample(s), duplicate sample(s).

Preparation and Analysis Requirements

- One water sample was received for LK4482 and prepared as batch 511bh and analyzed for selected analytes as requested on the chain of custody. Quality control analysis was performed on the following sample:

| Client ID | LAL # | | Method |
|-----------|---------|---------|---|
| BOFKH6 | L4482-5 | DUP | 160.1 TDS |
| | L4482-3 | MS, DUP | 300.0 Orthophosphate, Fluoride, Chloride, Nitrate-N, Nitrite-N, Sulfate |
| | L4482-4 | DUP | 310.1 Alkalinity |
| | L4482-6 | MS, DUP | CLP Cyanide |

Holding Time Requirements

- All samples were analyzed within the specified holding time.

Method Blanks

- The concentration levels of all the requested analytes in the method blank were below the reporting detection limits.

Internal Quality Control

- All Internal Quality Control were within acceptance limits.

Kay McCann

May 18, 1995

Prepared By

Date

am
7-24-95

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Chain-of-Custody Information

Bechtel Hanford, Inc.

L4482

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

Page 1 of 1

Data Turnaround

☐ Priority☒ Normal

| | | |
|---|--|---|
| Collector K. Lee | Company Contact G.L. Kasza | Telephone (509) 372-9675 |
| Project Designation 200-BP-5 Groundwater Round 3 | Sampling Location 200 East | SAF No. B95-049 |
| Ice Chest No. SML-371 | Field Logbook No. EFL-1129 | Method of Shipment Federal Express |
| Shipped To Lockheed | Offsite Property No. W95-0-03041-29 | Bill of Lading/Air Bill No. 7904627844 |

| | | | | | | | | | | | |
|--|---------------------|---|------------|----------|----------|------|---------|----------|------------------|----------|------|
| Possible Sample Hazards/Remarks | Preservation | HNO3 | Cool 4°C | Cool 4°C | Cool 4°C | NaOH | HNO3 | Cool 4°C | HCl | Cool 4°C | HNO3 |
| | Type of Container | P/G | G | P | P | P | P/G | G | P | P | P/G |
| | No. of Container(s) | 1 | 1 | 1 | 1 | 2 | 8 | 1 | 4 | 1 | 1 |
| Special Handling and/or Storage Maintain samples between 2°C and 6°C. | Volume | 1L | 500mL | 250mL | 500mL | 1L | 1L | 500mL | 1L | 20mL | 1L |
| SAMPLE ANALYSIS | *1 | Anions (IC)- F, Co, SO4, NO2, NO3, PO4 | Alkalinity | TDS | Cyanide | *2 | Tritium | Tc-99 | Activity Scan | *3 | |

| Sample No. | Matrix* | Date Sampled | Time Sampled | | | | | | | | | | |
|------------|---------|--------------|--------------|---|---|---|---|---|---|---|---|---|---|
| B0FKH6 | U | 5-9-95 | 1102 | X | X | X | X | X | X | X | X | X | |
| B0FKH7 | U | 5-9-95 | 1102 | | | | | | | | | | X |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

| | | | |
|--|---|---|-------------------|
| CHAIN OF POSSESSION | Sign/Print Names | SPECIAL INSTRUCTIONS | Matrix* |
| Relinquished By <i>K. Lee</i> Date/Time <i>5-9-95 1400</i> | Received By <i>ERC</i> Date/Time <i>1400</i> | *1 ICP Metals - to include Ca, Mg, Na, K, Fe, Mn, Si, Al, and Bi. AA Metals - to include Se (unfiltered). | S - Soil |
| Relinquished By <i>ERC</i> Date/Time <i>0900</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-9-95</i> | *2 Gross Alpha; Gross Beta; Pu-238, -239/240; Sr-90; Gamma Spec - to include Cs-137, Co-60, Ru-106; Total Uranium. | SE - Sediment |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | *3 ICP Metals - to include Ca, Mg, Na, K, Fe, Mn, Si, Al, and Bi. AA Metals - to include Se (filtered). | SO - Solid |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Sample analysis for PO4, NO2, NO3 by EPA 300.0 is being requested for information only. The ERC Contractor acknowledges that the 48-hour hold time will not be met. | SL - Sludge |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | The Activity Scan is for both sample numbers listed on this chain of custody. | W - Water |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | O - Oil |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | A - Air |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | DS - Drum Solids |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | DL - Drum Liquids |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | T - Tissue |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | WI - Wipe |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | L - Liquid |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | V - Vegetation |
| Relinquished By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | Received By <i>Bwh.Hen</i> Date/Time <i>5-10-95</i> | | X - Other |

| | | | |
|--------------------------|-------------------------------|-------------------------------|---------------------------------|
| LABORATORY SECTION | Received By <i>Bwh.Hen</i> | Title <i>Sample Custodian</i> | Date/Time <i>5-11-95 / 0845</i> |
| FINAL SAMPLE DISPOSITION | Disposal Method <i>000000</i> | Disposed By <i>Bwh.Hen</i> | Date/Time <i>5-11-95 / 0845</i> |

END OF PACKAGE

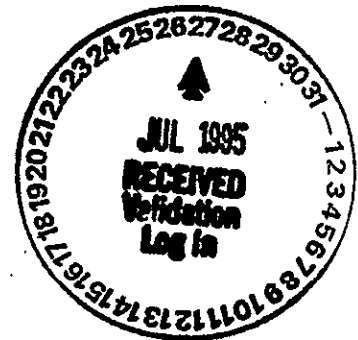


Los Alamos Technical Associates, Inc.

8633 Gage Blvd. / Kennewick, WA 99336 / Telephone (509) 783-4369 / FAX (509) 783-9661

July 27, 1995
LATA95-153

COPY



Ms. Joan Kessner
Bechtel
345 Hills
Richland, WA 99352

Subject: VB403.73, SDG LK4482-LAS

Dear Ms. Kessner:

Attached is the data validation report for analytical results for 200-BP-5 Groundwater Round 3, (SDG LK4482-LAS). The package was received by Los Alamos Technical Associates on July 10, 1995.

If you have any questions, please feel free to contact me.

Sincerely,

Marsha C. Webb

Marsha C. Webb
Deputy Project Manager

Attachment

cc: Jeanette Duncan, CH2M Hill
Don Smith, LATA
VB403.73
MCW/lb

CS

DATA VALIDATION REPORT
for
200-BP-5 GROUNDWATER ROUND 3
Metals Analysis
SDG LK4482-LAS
LATA VB403.73

Bechtel Hanford Inc.
P.O. Box 969
Richland, Washington

July 27, 1995

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**200-BP-5 Groundwater Round 3
Data Validation Narrative**

INTRODUCTION

All samples in Sample Delivery Group (SDG) LK4482-LAS (VB403.73) were validated at level "C" as defined in the Data Validation Procedures for Chemical Analysis (WHC-SD-EN-SPP-002, Rev. 2).

The analyses were performed by Lockheed Analytical Services.

ANALYSES REQUESTED

See Table 1.

DATA QUALITY OBJECTIVES

| | |
|------------------------------------|--|
| Precision: | Goals for precision were met. |
| Accuracy: | Goals for accuracy were met with the exception of those items discussed in the "Qualification Summary Table". |
| Sample Result Verification: | Not applicable to summary data packages that contain no raw data. |
| Detection Limits: | Detection limit goals were met for all sample results as specified in the <i>Quality Assurance Program Plan for 200-BP-5 Groundwater Operable Unit</i> , DOE/RL 88-32, Rev. 1. |
| Completeness: | The data package was 100% complete for all requested analyses. |

MAJOR DEFICIENCIES

No major deficiencies were identified during data validation which required qualification of data as unusable.

MINOR DEFICIENCIES

Minor deficiencies were identified during validation which required qualification of data as estimated. See the "Qualification Summary Table".

Table 1
Chain-of-Custody
Analysis Request

ATA ID #: VB403.73

SDG: LK4482-LAS

| Sample Information | | | | | | | Analyses Requested | | | |
|--------------------|----------------|--------|---------|-------------------|-----------------|---------|--------------------|---|---|---|
| SAMPLE NO. | DATE COLLECTED | MATRIX | SAF | SAMPLING LOCATION | FIELD QC INFO | TEMP °C | 1 | 2 | 3 | 4 |
| B0FKH6 | 9-May-95 | WATER | B95-049 | 299-E33-12 | Split w/ B0FB90 | 2 | X | | X | |
| B0FKH7 | 9-May-95 | WATER | B95-049 | 299-E33-12 | Split w/ B0FB91 | 2 | | X | | X |

Method References:

- | Analysis | Method |
|--|--------|
| 1. ICP Metals (Ca, Mg, Na, K, Fe, Mn, Si, Al, Bi) Unfiltered | CLP |
| 2. ICP Metals (Ca, Mg, Na, K, Fe, Mn, Si, Al, Bi) Filtered | CLP |
| 3. Selenium (Unfiltered) | CLP |
| 4. Selenium (Filtered) | CLP |

Method

CLP
CLP
CLP
CLP

REFERENCES

WHC 1993, *Data Validation Procedures for Chemical Analyses*, WHC-SD-EN-SPP-002, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

DOE 1994, *Quality Assurance Program Plan for 200-BP-5 Groundwater Operable Unit*, DOE/RL 88-32, Rev. 1, Department of Energy-Hanford, Richland, Washington.

GLOSSARY OF VALIDATION APPLIED QUALIFIERS (CHEMISTRY)

Qualifiers which may be applied by data validators in compliance with the procedures herein are as follows.

- U- Indicates the compound or analyte was analyzed for and not detected in the sample. The value reported is the sample quantitation limit corrected for sample dilution and moisture content by the laboratory.
- UJ- Indicates the compound or analyte was analyzed for and not detected in the sample. Due to a QC deficiency identified during data validation, the associated quantitation limit is an estimate.
- J- Indicates the compound or analyte was analyzed for and detected. The associated concentration is an estimate, but the data are usable for decision making purposes.
- BJ- Applied to inorganic analyses only. Indicates the analyte concentration was greater than the IDL but less than the CRDL and is considered an estimated value.
- R- Indicates the compound or analyte was analyzed for, detected, and due to an identified QC deficiency the data are unusable.
- UR- Indicates the compound or analyte was analyzed for and not detected in the sample. Additionally, the data are unusable due to an identified QC deficiency.

GLOSSARY OF LABORATORY APPLIED QUALIFIERS

Qualifiers which may be applied by the laboratory in compliance with applicable requirements are as follows.

Commonly used laboratory metals (inorganic) qualifiers:

- U- Indicates the analyte was analyzed for but not detected in the sample.
- B- Indicates the analyte concentration is less than the CRDL but greater than the IDL.
- E- Indicates the value reported is estimated due to the presence of interference.
- M- Indicates duplicate injection precision criteria were not met during graphite furnace (GFAA) analysis.
- N- Indicates spiked sample recovery was not within the control limits.
- S- Indicates the reported value was determined by the Method of Standard Additions (MSA).
- W- Indicates post-digestion spike for GFAA analysis is outside control limits and the sample absorbance is less than 50% of the spike absorbance.
- *- Indicates duplicate analysis was not within control limits.
- + - Indicates the correlation coefficient (r) for the MSA was less than 0.995.

Qualification Summary Table

Qualification Summary Table**Inorganics (Metals)**

| ANALYTE | TYPE | QUALIFIER | SAMPLES AFFECTED | DQO | REASON |
|---------|-------|-----------|---------------------|----------|---|
| Bismuth | MINOR | BJ | B0FKH7 | ACCURACY | Matrix spike recovery is outside acceptance criteria. |

Inorganics (Metals) Field QC

| ANALYTE | TYPE | QUALIFIER | FIELD QC SAMPLES | DQO | ASSESSMENT |
|---------|----------|-----------|--------------------------------|-----------|--------------------------------------|
| ALL | FIELD QC | NONE | B0FB90/B0FKH6 B0FB91/B0FKH7 | PRECISION | Field split precision is acceptable. |

Comments:

Data qualification is not required based on field split precision, however, field split results are summarized here to alert the data user to uncertainties in the data set during decision making processes.

Data Summary Table

METALS
DATA SUMMARY TABLE

| LATA ID#: VB403.73 | | HEIS #: | B0FKH6 | | B0FKH7 | |
|--------------------|-----------|---------|----------|---|----------|-----------|
| | | Date: | 9-May-95 | | 9-May-95 | |
| | | Matrix: | WATER | | WATER | |
| Constituent | CAS # | Units | Results | Q | Results | Q |
| Aluminum | 7429-90-5 | mg/L | 0.057 | U | 0.057 | U |
| Bismuth | 7440-69-9 | mg/L | 0.001 | U | 0.0014 | <u>BJ</u> |
| Calcium | 7440-70-2 | mg/L | 34 | | 34 | |
| Iron | 7439-89-6 | mg/L | 0.17 | | 0.019 | B |
| Magnesium | 7439-95-4 | mg/L | 10 | | 10 | |
| Manganese | 7439-96-5 | mg/L | 0.002 | U | 0.002 | U |
| Potassium | 7440-09-7 | mg/L | 8.8 | | 8.2 | |
| Selenium | 7782-49-2 | mg/L | 0.003 | U | 0.003 | U |
| Silicon | 7440-21-3 | mg/L | 28 | | 26 | |
| Sodium | 7440-23-5 | mg/L | 24 | | 23 | |

Sample Results (Form I's)

TOTAL METALS RESULTS

| | | |
|--------------------------|--------------------------|---------------|
| Client Sample ID: BOFKH6 | Date Collected: 05-09-95 | Matrix: water |
| LAL Batch ID(s): 511 bhT | Date Received: 05-11-95 | |

| Constituents | Method | Concentration (mg/L) | IDL (mg/L) | RDL (mg/L) | Data Qualifier(s) | Date Analyzed | LAL ID |
|--------------|--------|----------------------|------------|------------|-------------------|---------------|---------|
| Aluminum | CLP | <0.057 | 0.057 | 0.20 | U | 06-20-95 | L4482-2 |
| Bismuth | CLP | <0.001 | 0.001 | 0.005 | U | 06-28-95 | L4482-2 |
| Calcium | CLP | 34 | 0.056 | 5.0 | | 06-20-95 | L4482-2 |
| Iron | CLP | 0.17 | 0.010 | 0.10 | | 06-20-95 | L4482-2 |
| Magnesium | CLP | 10 | 0.057 | 5.0 | | 06-20-95 | L4482-2 |
| Manganese | CLP | <0.002 | 0.002 | 0.015 | U | 06-20-95 | L4482-2 |
| Potassium | CLP | 8.8 | 0.363 | 5.0 | | 06-20-95 | L4482-2 |
| Selenium | CLP | <0.003 | 0.003 | 0.005 | W | 06-19-95 | L4482-2 |
| Silicon | CLP | 28 | 0.012 | 0.10 | | 06-22-95 | L4482-2 |
| Sodium | CLP | 24 | 0.041 | 5.0 | | 06-20-95 | L4482-2 |

Comments:

000012

BM
7-17-95
054

DISSOLVED METALS RESULTS

| | | |
|--------------------------|--------------------------|------------------------|
| Client Sample ID: BOFKH7 | Date Collected: 05-09-95 | Matrix: filtered water |
| LAL Batch ID(s): 511 bhD | Date Received: 05-11-95 | |

| Constituents | Method | Concentration (mg/L) | IDL (mg/L) | RDL (mg/L) | Data Qualifier(s) | Date Analyzed | LAL ID |
|--------------|--------|----------------------|------------|------------|-------------------|---------------|----------|
| Aluminum | CLP | <0.057 | 0.057 | 0.20 | U | 06-16-95 | L4482-21 |
| Bismuth | CLP | 0.0014 | 0.001 | 0.005 | BN BJ | 06-28-95 | L4482-21 |
| Calcium | CLP | 34 | 0.056 | 5.0 | | 06-16-95 | L4482-21 |
| Iron | CLP | 0.019 | 0.010 | 0.10 | B | 06-16-95 | L4482-21 |
| Magnesium | CLP | 10 | 0.057 | 5.0 | | 06-16-95 | L4482-21 |
| Manganese | CLP | <0.002 | 0.002 | 0.015 | U | 06-16-95 | L4482-21 |
| Potassium | CLP | 8.2 | 0.363 | 5.0 | | 06-16-95 | L4482-21 |
| Selenium | CLP | <0.003 | 0.003 | 0.005 | W | 06-17-95 | L4482-21 |
| Silicon | CLP | 26 | 0.012 | 0.10 | | 06-22-95 | L4482-21 |
| Sodium | CLP | 23 | 0.041 | 5.0 | | 06-16-95 | L4482-21 |

Comments:

BM
7-17-95

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Checklist

**LATA INORGANIC (METALS)
DATA VALIDATION CHECKLIST**

| VALIDATION LEVEL: | A | B | C | D | E |
|---|---|---|---|---|---|
| VALIDATION PROCEDURE: | <input type="checkbox"/> WHC-CM-5-3, Rev. 0 | | <input checked="" type="checkbox"/> WHC-SD-EN-SPP-002, Rev. 2 | | |
| PROJECT: 200-BP-5 ROUND 3 | | | SDG: LK4482-QES | | |
| VALIDATOR: BJ MORRIS <i>7-18-95</i> | LATA NO: VB403.73 | | DATE: 17-Jul-95 | | |
| REVIEWER: MC WEBB <i>7-25-95</i> | LAB: QES | | CASE: N/A | | |
| SAF NO: B95-049 | QAPP NO: N/A | | SAP NO: DOE/RL 88-32,R1 | | |
| ANALYSES REQUESTED | | | | | |
| <input checked="" type="checkbox"/> ICP Metals Unfiltered CLP | <input checked="" type="checkbox"/> Selenium Unfiltered CLP | <input checked="" type="checkbox"/> ICP Metals Filtered CLP | <input checked="" type="checkbox"/> Selenium Filtered CLP | | |
| SAMPLE NO. BOFKH6 | MATRIX WATER | SAMPLE NO. BOFKH7 | MATRIX WATER | | |

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

YES NO N/A

Is technical verification documentation present?

☒ ☐ ☐

Is a case narrative present?

☒ ☐ ☐

2. HOLDING TIMES

YES NO N/A

Are sample holding times acceptable?

☒ ☐ ☐

See HOLDING TIME SUMMARY form

3. INSTRUMENT PERFORMANCE AND CALIBRATIONS

YES NO N/A

Were initial calibrations performed on all instruments?

☐ ☐ ☒

Are initial calibrations acceptable?

☐ ☐ ☒

Are ICP interference checks acceptable?

☐ ☐ ☒

Were ICV and CCV checks performed on all instruments?

☐ ☐ ☒

Are ICV and CCV checks acceptable?

☐ ☐ ☒

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

If NO(s) are checked, see CALIBRATION DATA SUMMARY form

**LATA INORGANIC (METALS)
DATA VALIDATION CHECKLIST**

4. BLANKS

Were ICB and CCB checks performed for all applicable analyses?

YES NO N/A

☐ ☐ ☒

Are ICB and CCB results acceptable?

☐ ☐ ☒

Were preparation blanks analyzed?

☒ ☐ ☐

Are preparation blank results acceptable?

☒ ☐ ☐

If NO(s) are checked, see BLANK AND SAMPLE DATA SUMMARY form

5. ACCURACY

Were spike samples analyzed at the proper frequency?

YES NO N/A

☒ ☐ ☐

Are all spike sample recoveries acceptable?

☐ ☒ ☐

Are all elements spiked at an appropriate level?

☐ ☐ ☒

Was a post digestion spike analyzed?

☐ ☒ ☐

Are all post digestion spike recoveries acceptable?

☐ ☐ ☒

Were laboratory control samples (LCS) analyzed at the proper frequency?

☐ ☐ ☒

Are all LCS recoveries acceptable?

☐ ☐ ☒

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

If NO(s) are checked, see ACCURACY DATA SUMMARY form

6. PRECISION

Were laboratory duplicates analyzed at the proper frequency?

YES NO N/A

☒ ☐ ☐

Are all duplicate RPD values acceptable?

☒ ☐ ☐

Were MS/MSDs analyzed?

☐ ☐ ☒

Are all MS/MSD RPD values acceptable?

☐ ☐ ☒

Were ICP serial dilution samples analyzed at the proper frequency?

☐ ☐ ☒

Are all ICP serial dilution %D values acceptable?

☐ ☐ ☒

Validation calculation checks were performed and are acceptable.

☐ ☐ ☒

If NO(s) are checked, see PRECISION DATA SUMMARY form

**LATA INORGANIC (METALS)
DATA VALIDATION CHECKLIST**

7. FIELD QC SAMPLES

Were field QC samples (field/trip blanks, duplicates, splits, performance audit) identified?
Are field/trip blank results acceptable? (see Blank Data Summary form)
Are field duplicate RPD values acceptable? (see Field QC evaluation)
Are field split RPD values acceptable? (see Field QC evaluation)
Are performance audit sample results acceptable?

YES NO N/A

| | | |
|-------------------------------------|--------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Comments: B0FKH6 is a field split with B0FB90.

B0FKH7 is a field split with B0FB91.

B0FB90 and B0FB91 were validated in SDG W0548-QES (VB403.71).

8. FURNACE AA QUALITY CONTROL

Were duplicate injections required?
Are all duplicate injection %RSD values acceptable?
Were analytical spikes required?
Are all analytical spike recoveries acceptable?
Was MSA required?
Are all MSA results acceptable?
Validation calculation checks were performed and are acceptable.

YES NO N/A

| | | |
|--------------------------|--------------------------|-------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Comments:

9. REPORTED RESULTS AND DETECTION LIMITS

Are results reported for all requested analyses?
Are all results supported in the raw data?
Are results calculated properly?
Do results meet the CRDLs?
Validation calculation checks were performed and are acceptable.

YES NO N/A

| | | |
|-------------------------------------|--------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Comments:

VALIDATION SUMMARY

For deficiencies (major and minor) and comments, please refer to the Qualification Summary Table.

**LATA INORGANIC (METALS)
DATA VALIDATION CHECKLIST**

HOLDING TIME SUMMARY

| SDG: LK4482-LAS | | | VALIDATOR: BJ MORRIS | | | | | DATE: 17-Jul-95 | | |
|---------------------------|-------------|--|----------------------|-----------|---------------|----------------|--------------------|--------------------|--------------------|-------|
| PROJECT: 200-BP-5 ROUND 3 | | | REVIEWER: MC WEBB | | | | | LATA NO.: VB403.73 | | |
| HEIS-SN | MATRIX CODE | ANALYSIS | DATE COLLECTED | PREP DATE | ANALYSIS DATE | PREP HT (days) | Required HT (days) | ANALYSIS HT (days) | Required HT (days) | VAL Q |
| B0FKH6 | WATER | Aluminum Calcium Iron Magnesium Manganese Potassium Sodium | 9-May-95 | N/A | 16-Jun-95 | N/A | N/A | 38 | 180 | NONE |
| B0FKH6 | WATER | Bismuth | 9-May-95 | N/A | 28-Jun-95 | N/A | N/A | 50 | 180 | NONE |
| B0FKH6 | WATER | Selenium | 9-May-95 | N/A | 17-Jun-95 | N/A | N/A | 39 | 180 | NONE |
| B0FKH6 | WATER | Silicon | 9-May-95 | N/A | 22-Jun-95 | N/A | N/A | 44 | 180 | NONE |
| B0FKH7 | WATER | Aluminum Calcium Iron Magnesium Manganese Potassium Sodium | 9-May-95 | N/A | 20-Jun-95 | N/A | N/A | 42 | 180 | NONE |
| B0FKH7 | WATER | Bismuth | 9-May-95 | N/A | 28-Jun-95 | N/A | N/A | 50 | 180 | NONE |
| B0FKH7 | WATER | Selenium | 9-May-95 | N/A | 19-Jun-95 | N/A | N/A | 41 | 180 | NONE |
| B0FKH7 | WATER | Silicon | 9-May-95 | N/A | 22-Jun-95 | N/A | N/A | 44 | 180 | NONE |

000018

LATA INORGANIC (METALS)
DATA VALIDATION CHECKLIST

ACCURACY DATA SUMMARY

| | | | | | | | | | | | | |
|---------------------------|---------|---------|-------|----------------------|--------------------------------|------------|-----------------------|------------------------|----------------------|-----------------------------|------------------|-------|
| SDG: LK4482-LAS | | | | | VALIDATOR: BJ MORRIS | | | | | DATE: 17-Jul-95 | | |
| PROJECT: 200-BP-5 ROUND 3 | | | | | REVIEWER: MC WEBB | | | | | LATA NO.: VB403.73 | | |
| HEIS-SN | ANALYTE | RESULTS | Lab Q | Actual Spiking Level | Minimum Required Spiking Level | Difference | PERCENT RECOVERY (%R) | | | | SAMPLES AFFECTED | VAL Q |
| | | | | | | | Matrix Spike | Matrix Spike Duplicate | Post Digestion Spike | Laboratory Control Standard | | |
| B0FKH6 | Silicon | 28.27 | | 2.0 | 7.0675 | -5.0675 | NR | | | | NONE | NONE |
| B0FKH7 | Silicon | 26.05 | | 2.0 | 6.5125 | -4.5125 | NR | | | | NONE | NONE |
| B0FKH7 | Bismuth | 0.0014 | | 0.20 | 0.00035 | 0.19965 | 27.4% | | | | B0FKH7 | BJ |

NOTES:

- (1) A negative number in the difference column indicates the spiking level for that element was not 25% of the sample concentration.
The CLP method does not require qualification of sample data when this occurs.
- (2) NR = not reported

000019

METALS QC DATA SUMMARY

For Matrix Spike Sample Analysis

LAL Batch ID(s): 511 bhT

| Constituent | Client Sample ID | LAL Sample ID | Date Analyzed | QC Sample Analyses | | | | |
|-------------|------------------|---------------|---------------|----------------------------|----------------------|--------------------|--------------|----------------|
| | | | | Matrix Spike Result (mg/L) | Sample Result (mg/L) | Spike Added (mg/L) | (%) Recovery | Data Qualifier |
| Aluminum | BOFKH6 | L4482-2 | 06-20-95 | 2.184 | <0.057 | 2.0 | 109 | |
| Bismuth | BOFKH6 | L4482-2 | 06-28-95 | 0.1810 | <0.001 | 0.20 | 91 | |
| Calcium | BOFKH6 | L4482-2 | 06-20-95 | 140.3 | 33.91 | 100 | 106 | |
| Iron | BOFKH6 | L4482-2 | 06-20-95 | 1.284 | 0.1736 | 1.0 | 111 | |
| Magnesium | BOFKH6 | L4482-2 | 06-20-95 | 65.13 | 10.40 | 50 | 109 | |
| Manganese | BOFKH6 | L4482-2 | 06-20-95 | 0.5374 | <0.002 | 0.50 | 107 | |
| Potassium | BOFKH6 | L4482-2 | 06-20-95 | 63.66 | 8.830 | 50 | 110 | |
| Selenium | BOFKH6 | L4482-2 | 06-19-95 | 0.0117 | <0.003 | 0.010 | 117 | |
| Silicon | BOFKH6 | L4482-2 | 06-22-95 | 29.14 | 28.27 | 2.0 | a | |
| Sodium | BOFKH6 | L4482-2 | 06-20-95 | 134.6 | 24.49 | 100 | 110 | |

"a" - The matrix spike recovery is not reported. The sample concentration was greater than four times the spiking level.

COMMENTS:

Bm
7-17-95

000020

057

METALS QC DATA SUMMARY

For Matrix Spike Sample Analysis

LAL Batch ID(s): 511 bhd

| Constituent | Client Sample ID | LAL Sample ID | Date Analyzed | QC Sample Analyses | | | | |
|-------------|------------------|---------------|---------------|----------------------------|----------------------|--------------------|--------------|----------------|
| | | | | Matrix Spike Result (mg/L) | Sample Result (mg/L) | Spike Added (mg/L) | (%) Recovery | Data Qualifier |
| Aluminum | BOFKH7 | L4482-21 | 06-16-95 | 1.926 | <0.057 | 2.0 | 96 | |
| Bismuth | BOFKH7 | L4482-21 | 06-28-95 | 0.05613 | 0.0014 | 0.20 | 27 | N |
| Calcium | BOFKH7 | L4482-21 | 06-16-95 | 133.4 | 33.58 | 100 | 100 | |
| Iron | BOFKH7 | L4482-21 | 06-16-95 | 1.036 | 0.0186 | 1.0 | 102 | |
| Magnesium | BOFKH7 | L4482-21 | 06-16-95 | 59.90 | 10.10 | 50 | 100 | |
| Manganese | BOFKH7 | L4482-21 | 06-16-95 | 0.5043 | <0.002 | 0.50 | 101 | |
| Potassium | BOFKH7 | L4482-21 | 06-16-95 | 55.56 | 8.164 | 50 | 95 | |
| Selenium | BOFKH7 | L4482-21 | 06-17-95 | 0.0109 | <0.003 | 0.010 | 109 | |
| Silicon | BOFKH7 | L4482-21 | 06-22-95 | 27.29 | 26.05 | 2.0 | a | |
| Sodium | BOFKH7 | L4482-21 | 06-16-95 | 117.6 | 22.74 | 100 | 95 | |

COMMENTS:

BM
7-17-95

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062

METALS FIELD SPLIT EVALUATION

| LATA ID#: VB403.73 | | HEIS #: | B0FB90 | HEIS #: | B0FKH6 | RPD | DIF | DL |
|--------------------|-----------|---------|----------|---------|----------|---------|-----|------|
| | | Date: | 9-May-95 | Date: | 9-May-95 | | | |
| | | Matrix: | WATER | Matrix: | WATER | | | |
| | | | ORIGINAL | | SPLIT | | | |
| Constituent | CAS # | Units | Results | Q | Units | Results | Q | |
| Aluminum | 7429-90-5 | µg/L | 23.4 | U | mg/L | 0.057 | U | |
| Antimony | 7440-36-0 | µg/L | 26.3 | U | mg/L | N/R | | |
| Arsenic | 7440-38-2 | µg/L | 1.4 | BJ | mg/L | N/R | | |
| Barium | 7440-39-3 | µg/L | 87.4 | B | mg/L | N/R | | |
| Beryllium | 7440-41-7 | µg/L | 0.60 | U | mg/L | N/R | | |
| Cadmium | 7440-43-9 | µg/L | 2.4 | UJ | mg/L | N/R | | |
| Calcium | 7440-70-2 | µg/L | 30400 | J | mg/L | 34 | | 5000 |
| Chromium | 7440-47-3 | µg/L | 4.7 | U | mg/L | N/R | | |
| Cobalt | 7440-48-4 | µg/L | 3.4 | U | mg/L | N/R | | |
| Copper | 7440-50-8 | µg/L | 9.8 | U | mg/L | N/R | | |
| Iron | 7439-89-6 | µg/L | 128 | | mg/L | 0.170 | | 100 |
| Lead | 7439-92-1 | µg/L | 0.80 | UJ | mg/L | N/R | | |
| Magnesium | 7439-95-4 | µg/L | 9280 | J | mg/L | 10 | | 5000 |
| Manganese | 7439-96-5 | µg/L | 3.4 | B | mg/L | 0.002 | U | 15.0 |
| Nickel | 7440-02-0 | µg/L | 15.4 | U | mg/L | N/R | | |
| Potassium | 7440-09-7 | µg/L | 6920 | J | mg/L | 8.8 | | 5000 |
| Selenium | 7782-49-2 | µg/L | 1.1 | U | mg/L | 0.003 | U | |
| Silver | 7440-22-4 | µg/L | 4.1 | U | mg/L | N/R | | |
| Sodium | 7440-23-5 | µg/L | 21100 | J | mg/L | 24 | | 5000 |
| Thallium | 7440-28-0 | µg/L | 0.90 | U | mg/L | N/R | | |
| Vanadium | 7440-62-2 | µg/L | 18.1 | B | mg/L | N/R | | |
| Zinc | 7440-66-6 | µg/L | 12.5 | U | mg/L | N/R | | |
| Cyanide | CYANIDE | µg/L | 20.7 | J | mg/L | N/R | | |
| Silicon | 7440-21-3 | µg/L | 26000 | | mg/L | 28 | | 100 |
| Bismuth | 7440-69-9 | µg/L | 46.4 | U | mg/L | 0.001 | U | |

'NR' = Not Requested

EVALUATION:

1. Field duplicates are not evaluated for precision if both results are non-detect.
2. If both sample results are >5*DL the RPD is used for evaluation.
3. If either sample result is <5*DL the DIF is used for evaluation.
4. All positive results have exhibited acceptable precision.

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Shaded areas indicate changes by the validator.
40373DST.XLS, METALS FIELD SPLIT

7/25/95, 9:22 AM

METALS FIELD SPLIT EVALUATION

| LATA ID#: VB403.73 | | HEIS #: | B0FB91 | HEIS #: | B0FKH7 | RPD | DIF | DL |
|--------------------|-----------|---------|----------|---------|----------|---------|-----|------|
| | | Date: | 9-May-95 | Date: | 9-May-95 | | | |
| | | Matrix: | WATER | Matrix: | WATER | | | |
| | | | ORIGINAL | | SPLIT | | | |
| Constituent | CAS # | Units | Results | Q | Units | Results | Q | |
| Aluminum | 7429-90-5 | µg/L | 23.4 | U | mg/L | 0.057 | U | |
| Antimony | 7440-36-0 | µg/L | 26.3 | U | mg/L | NR | | |
| Arsenic | 7440-38-2 | µg/L | 1.4 | BJ | mg/L | NR | | |
| Barium | 7440-39-3 | µg/L | 84.0 | B | mg/L | NR | | |
| Beryllium | 7440-41-7 | µg/L | 0.60 | U | mg/L | NR | | |
| Cadmium | 7440-43-9 | µg/L | 2.4 | UJ | mg/L | NR | | |
| Calcium | 7440-70-2 | µg/L | 29800 | J | mg/L | 34 | | 5000 |
| Chromium | 7440-47-3 | µg/L | 4.7 | U | mg/L | NR | | |
| Cobalt | 7440-48-4 | µg/L | 3.4 | U | mg/L | NR | | |
| Copper | 7440-50-8 | µg/L | 13.6 | BJ | mg/L | NR | | |
| Iron | 7439-89-6 | µg/L | 37.9 | U | mg/L | 0.019 | B | 100 |
| Lead | 7439-92-1 | µg/L | 1.0 | BJ | mg/L | NR | | |
| Magnesium | 7439-95-4 | µg/L | 9030 | J | mg/L | 10 | | 5000 |
| Manganese | 7439-96-5 | µg/L | 3.2 | B | mg/L | 0.002 | U | 15.0 |
| Nickel | 7440-02-0 | µg/L | 15.4 | U | mg/L | NR | | |
| Potassium | 7440-09-7 | µg/L | 7430 | J | mg/L | 8.2 | | 5000 |
| Selenium | 7782-49-2 | µg/L | 1.1 | U | mg/L | 0.003 | U | |
| Silver | 7440-22-4 | µg/L | 4.1 | U | mg/L | NR | | |
| Sodium | 7440-23-5 | µg/L | 20300 | J | mg/L | 23 | | 5000 |
| Thallium | 7440-28-0 | µg/L | 0.90 | U | mg/L | NR | | |
| Vanadium | 7440-62-2 | µg/L | 17.2 | B | mg/L | NR | | |
| Zinc | 7440-66-6 | µg/L | 12.8 | U | mg/L | NR | | |
| Cyanide | CYANIDE | µg/L | NR | | mg/L | NR | | |
| Silicon | 7440-21-3 | µg/L | 25400 | | mg/L | 26 | | 100 |
| Bismuth | 7440-69-9 | µg/L | 46.4 | U | mg/L | 0.0014 | BJ | 5 |

'NR' = Not Requested

EVALUATION:

1. Field duplicates are not evaluated for precision if both results are non-detect.
2. If both sample results are >5*DL the RPD is used for evaluation.
3. If either sample result is <5*DL the DIF is used for evaluation.
4. All positive results have exhibited acceptable precision.

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Shaded areas indicate changes by the validator.
40373DST.XLS, METALS FIELD SPLIT

7/25/95, 9:22 AM

Laboratory Case Narrative

CASE NARRATIVE INORGANIC METALS ANALYSES

The routine calibration and quality control analyses performed for this batch include as applicable: instrument tune (ICP/MS only), initial and continuing calibration verification, initial and continuing calibration blanks, method blank(s), laboratory control sample(s), ICP interference check samples (ICP only), serial dilutions, analytical (post-digestion) spike samples, matrix spike (predigestion) sample(s), duplicate sample(s).

Preparation and Analysis Requirements

The samples were received in on May 11, 1995. They were logged in as L4482 and prepared and analyzed in batches 511 bhT for total metals and 511 bhD for filtered water.

Holding Times-

All samples were analyzed within the method-specific holding times.

Method Blanks-

The method blanks were free of contamination.

Internal Quality Control-

All Internal Quality Control were within acceptance limits with the following exception: The matrix spike recovery for bismuth in the filtered water analysis was outside of acceptance limits (27%). The recovery based on the LCS (99%) support that the analytical system was operating within control limits.

Sample Results-

Bismuth was determined by ICP-MS, as approved by Clay Smith of Bechtel Hanford.

Shellee McGrath
Prepared By

June 29, 1995
Date

7-25-95

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006

Chain-of-Custody Information

Bechtel Hanford, Inc.

L4482

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

Page 1 of 1

Data Turnaround

☐ Priority☒ Normal

| | | | | | | | | | | | |
|--|--|------|--|------------|---|---------|------|----------|-------|------------------|------|
| Collector K. Lee | Company Contact G.L. Kasza | | | | Telephone (509) 372-9675 | | | | | | |
| Project Designation 200-BP-5 Groundwater Round 3 | Sampling Location 200 East | | | | SAF No. B95-049 | | | | | | |
| Ice Chest No. SML-371 | Field Logbook No. ZFL-1129 | | | | Method of Shipment Federal Express | | | | | | |
| Shipped To Lockheed | Offsite Property No. W95-0-03041-29 | | | | Bill of Lading/Air Bill No. 2904627744 | | | | | | |
| Possible Sample Hazards/Remarks | Preservation | HNO3 | Cool 4°C | Cool 4°C | Cool 4°C | NaOH | HNO3 | Cool 4°C | HCl | Cool 4°C | HNO3 |
| | Type of Container | P/G | G | P | P | P | P/G | G | P | P | P/G |
| | No. of Container(s) | 1 | 1 | 1 | 1 | 2 | 8 | 1 | 4 | 1 | 1 |
| Special Handling and/or Storage Maintain samples between 2°C and 6°C. | Volume | 1L | 500mL | 250mL | 500mL | 1L | 1L | 500mL | 1L | 20mL | 1L |
| SAMPLE ANALYSIS | | *1 | Anions (IC- F, Co, SO4, NO2, NO3, PO4 | Alkalinity | TDS | Cyanide | *2 | Tritium | Tc-99 | Activity Scan | *3 |

| Sample No. | Matrix* | Date Sampled | Time Sampled | | | | | | | | | | |
|------------|---------|--------------|--------------|---|---|---|---|---|---|---|---|---|---|
| B0FKH6 | U | 5-9-95 | 1102 | X | X | X | X | X | X | X | X | X | |
| B0FKH7 | U | 5-9-95 | 1102 | | | | | | | | | | X |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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| | | | | | | | | |
|-------------------------------|--------------------------|---------------------------|---------------------|---|--|--|--|--------------------|
| CHAIN OF POSSESSION | | Sign/Print Names | | SPECIAL INSTRUCTIONS | | | | Matrix* |
| Relinquished By K. Lee | Date/Time 5-9-95 1400 | Received By G.L. Kasza | Date/Time 5-9-95 | *1 ICP Metals - to include Ca, Mg, Na, K, Fe, Mn, Si, Al, and Bi. AA Metals - to include Se (unfiltered). | | | | S = Soil |
| Relinquished By G.L. Kasza | Date/Time 5-9-95 0900 | Received By B. Whitten | Date/Time 5-9-95 | *2 Gross Alpha; Gross Beta; Pu-238, -239/240; Sr-90; Gamma Spec - to include Ca-137, Co-60, Ru-106; Total Uranium. | | | | SE = Sediment |
| Relinquished By B. Whitten | Date/Time 5-10-95 | Received By | Date/Time | *3 ICP Metals - to include Ca, Mg, Na, K, Fe, Mn, Si, Al, and Bi. AA Metals - to include Se (filtered). | | | | SO = Solid |
| Relinquished By | Date/Time | Received By | Date/Time | Sample analysis for PO4, NO2, NO3 by EPA 300.0 is being requested for information only. The ERC Contractor acknowledges that the 48-hour hold time will not be met. | | | | SL = Sludge |
| Relinquished By | Date/Time | Received By | Date/Time | The Activity Scan is for both sample numbers listed on this chain of custody. | | | | W = Water |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | O = Oil |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | A = Air |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | DS = Drums Solids |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | DL = Drums Liquids |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | T = Tissue |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | WI = Wipe |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | L = Liquid |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | V = Vegetation |
| Relinquished By | Date/Time | Received By | Date/Time | | | | | X = Other |

| | | | |
|--------------------------|---------------------------|---------------------------|-----------------------------|
| LABORATORY SECTION | Received By M. Miller | Title Sample Custodian | Date/Time 5-11-95 / 0845 |
| FINAL SAMPLE DISPOSITION | Disposal Method 000000 | Disposed By | Date/Time |

Lockheed Analytical Services Sample Receiving Checklist

Page 1 of

Client Name: *NPS Dinghouse Hanford*

Job No. *L4482*

Cooler ID: *107*

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: *22*

temperature of temp. blank upon receipt: *1*

| | Yes | No | * Comments/Discrepancies |
|-------------------------------------|-------------------------------------|----|--------------------------|
| custody seals intact | <input checked="" type="checkbox"/> | | |
| chain of custody present | <input checked="" type="checkbox"/> | | |
| blue ice (or equiv.) present/frozen | <input checked="" type="checkbox"/> | | |
| rad survey completed | <input checked="" type="checkbox"/> | | |

SAMPLE CONDITION UPON RECEIPT

| | Yes | No | * Comments/Discrepancies |
|--|-------------------------------------|------------|--------------------------|
| all bottles labeled | <input checked="" type="checkbox"/> | | |
| samples intact | <input checked="" type="checkbox"/> | | |
| proper container used for sample type | <input checked="" type="checkbox"/> | | |
| sample volume sufficient for analysis | <input checked="" type="checkbox"/> | | |
| proper pres. indicated on the COC | <input checked="" type="checkbox"/> | | |
| VOA's contain headspace | | <i>N/A</i> | |
| are samples bi-phasic (if so, indicate sample ID'S): | | <i>N/A</i> | |

MISCELLANEOUS ITEMS

| | Yes | No | * Comments/Discrepancies |
|----------------------------------|-------------------------------------|------------|--------------------------|
| samples with short holding times | <input checked="" type="checkbox"/> | | <i>7/12/12 / DIRECTO</i> |
| samples to subcontract | | <i>N/A</i> | |

ADDITIONAL COMMENTS/DISCREPANCIES

Completed by / date: *Paul C. Davis 5-11-95*

Sent to the client (date/initials):

** Client's signature upon receipt:

Notes: * = contact the appropriate CSR of any discrepancies immediately upon receipt

** = please review this information and return via facsimile to the appropriate CSR (702) 361-8146

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7/11/95
022
11/11/94

END OF PACKAGE